DECEMBER 29, 1952

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

5/8% STEP VOLTAGE REGULATORS

Keep Revenue Up

as feeder loads increase

SOMETIMES IT'S QUITE A WAIT for construction crews to get overloaded feeders rebuilt. But you won't be losing revenue during the waiting period if you have Allis-Chalmers distribution regulators on the line. They guarantee an accurate ± 1 volt band that keeps revenue — and profits — climbing with increases in loads.

Best of all, you've got a flexible tool for solving voltage problems anywhere. Allis-Chalmers distribution regulators are easy to mount — they can be shifted from feeder to feeder easily as changing loads require.

Don't let rising loads cut into profits. Call your nearest A-C district office for full information. Or write Allis-Chalmers, Milwaukee 1, Wis.

A-3881

RATINGS AVAILABLE	7620 Volts—15, 50, 100 amp 5000 Volts—50, 100 amp 2500 Volts—100, 200 amp

Feather-Touch controls cut service costs

Setting the control when you install an Allis-Chalmers distribution regulator is easy, thanks to the convenience of Feather-Touch controls. There's only one adjustment needed — setting the calibrated voltage level.

Maintenance is equally easy because a single jack plug connects all wiring to the regulator. The control can be removed and replaced in a jiffy.

Get all the facts. Write for bulletin 01M7866-1.

ALLIS-CHALMERS

Originators of ⅝% Step Regulation

3 Men on an Article

Usually engineering articles in Electrical World are the result of the inspiration and perspiration of one man. But there are exceptions. One of them is "Develop 120-Square Mile Primary Network," beginning on Page 68 of this issue. Here three engineers of the Public Service Co of Northern Illinois have teamed together to tell the story of an outstanding primary network. The three are R. O. Askey, R. P. Burandt, and H. D. Ely. All are electrical engineers, but each got his degree from a different engineering school.

Askey Is a Church Worker . . . Askey, senior of the three with the company, got on the payroll in 1926 after receiving his diploma from the University of Illinois. Since then he has had broad experience in distribution design, system planning, and operating work. Askey has made his work his hobby. And to his good work here he has added good work in a more literal sense. He teaches Sunday School and serves on the building committee of his church.

Burandt Has MS Degree . . . Burandt, the "youngster" of the trio, is also an active church worker. But he has two hobbies in photography and wood working. A graduate of Rose Polytechnic Institute in 1948, he joined the utility in 1950 while studying at Illinois Institute of Technology where he received his master's degree in electrical engineering in 1951.

Ely Entered Industry in High School Days . . . Ely received his introduction to the industry in his high school days. When the engineer in the power plant in his home town in Kansas quit, HD took over. However, he admits that this was during the days of the "moonlight" schedule. In 1925 armed with a sheepskin from the University of Kansas, he went to work for Westinghouse. After stops at West Penn Power Co and Kansas City Power & Light Co, he joined Public Service in 1929. He has a rare hobby for a Midwesterner, deep sea fishing. If he wants to do very much of it, he may find that his other hobby, flying, is a big help.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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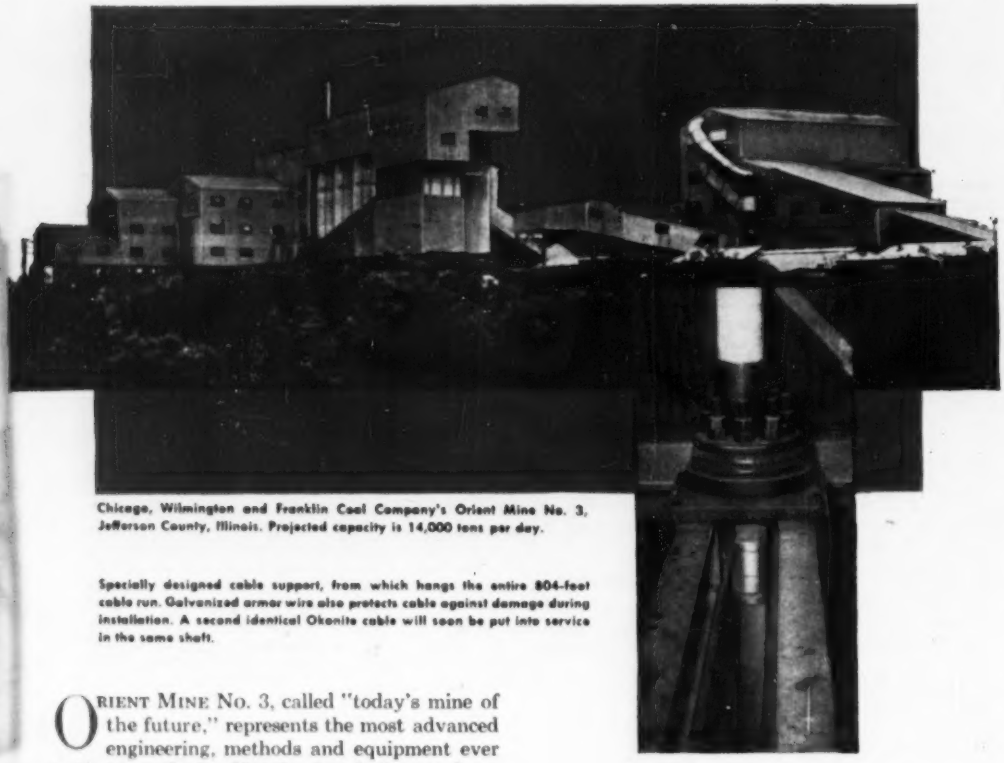
OKONITE CABLES supply underground power to world's most modern mine



Chicago, Wilmington and Franklin Coal Company's Orient Mine No. 3, Jefferson County, Illinois. Projected capacity is 14,000 tons per day.

Specially designed cable support, from which hangs the entire 804-foot cable run. Galvanized armor wire also protects cable against damage during installation. A second identical Okonite cable will soon be put into service in the same shaft.

ORIENT MINE No. 3, called "today's mine of the future," represents the most advanced engineering, methods and equipment ever put into a coal mine. To take electrical power down the 800-foot shaft, the mine's engineers specified one of the highest voltage shaft cables ever to be installed in an Illinois mine—an 8-ton, 8,000 volt, shielded Okonite cable.

Key to the unusual reliability of this primary feeder cable under shaft-hole conditions is its Okolite insulation. This high voltage insulation resists corona cutting, moisture and heat, maintains its stable electrical characteristics under heavy current throughout a long service life.

Okolite insulation has been used more than a quarter of a century for unusual installation like this, as well as for control wiring, underground systems and submarine cables. The same exclusive method of strip insulating, the same ultra-high voltage testing, the same carefully developed compound, is used on *all* Okolite insulated cable to insure against premature cable failure with your electrical circuits.

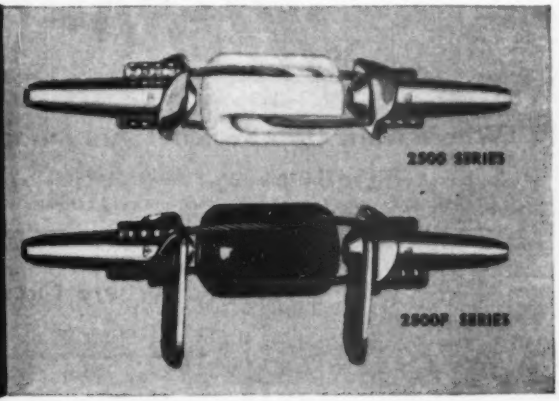
On all key circuits—circuits whose failure would mean loss of production and down time—specify rugged, long-lasting cables engineered and manufactured by The Okonite Company, Passaic, N. J.

The best cable is your best policy

OKONITE SINCE 1878 *insulated wires and cables*

for the largest number of line applications at the lowest possible cost...

USE *Electroline* Insulating Automatic Line Splice SECTIONALIZERS



The Electroline Sectionalizers are assemblies that will function in service as most convenient, reliable and yet low cost interrupting devices. Series 2500-F and 2600 provide for paralleling with a fuse element for further protection when sectionalizing. The mechanical strength of these assemblies exceeds in all cases the rated breaking strength of the conductor for which they are adapted.

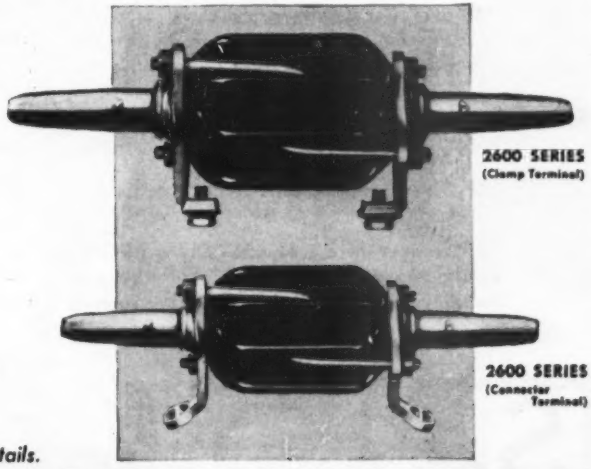
These Insulating Automatic Line Splice Sectionalizers are ideal for:

Installing Regulating Equipment,
simplifies cutting-in disconnecting points, fuses, voltage regulators and series capacitors;

Restoring Service,
providing points to test for trouble;

Sectionalizing Networks,
to readily isolate and test the area in trouble;

Series Street Lighting,
simplifies cutting-in series street lamps—merely cut the line and insert conductor ends into sectionalizer.



Send for Bulletins containing complete details.

PATENTS TO ORIGINATE · E · ABILITY TO PRODUCE

Electroline Company

4121 South La Salle Street • Chicago 9, Illinois
In Canada: POWERLITE DEVICES, LTD., TORONTO

Alduti INTERRUPTER SWITCHES

① Where Horn Gap Switches Are Inadequate

because horn gaps cannot, under all conditions, safely break magnetizing or charging currents; nor can they interrupt load currents

② Where Circuit Breakers Are Too Expensive

for non-automatic switching and short circuit protection

ALDUTI INTERRUPTER SWITCHES

offer a proved and economical solution to such application problems.

Ten years of operating experience in thousands of installations, and many field trials under severe test conditions, have demonstrated the ability of these Interrupter Switches to — safely and repeatedly —

- Sectionalize either radial or loop distribution and subtransmission circuits, under either load or charging current conditions . . .
- Switch load and magnetizing currents of transformer banks . . .
- Switch charging currents of capacitor banks.

And because there is NO EXTERNAL ARCING during the operation of Alduti Interrupter Switches: they need not be mounted horizontally upright, but can be mounted vertically, or underhung; hook stick operation can be employed where economy dictates; and phase spacings can be reduced to 18 inches for the 7,500-volt and 33 inches for the 34,500-volt switches. Hence structures can be smaller, connections simpler, and construction cost can be reduced below that of installing horn gap switches.

Also, Alduti Interrupter Switches can be metal-clad, thus providing—even for subtransmission applications — enclosed "packaged-type" switches, thereby permitting the complete enclosure of all components of a substation.

When combined with S&C Power Fuses, Alduti Fused Interrupters also provide short circuit protection with fault current interrupting ability up to 40,000 amperes asymmetrical, thus making possible the elimination of expensive circuit breakers where automatic switching is not required.

Alduti Interrupter Switches are supplied in these ratings:

Volts	Continuous Amperes	Interrupting Amperes, Nominal
For hook stick or group operation		
7500 & 15000	400, 600, 1200	400, 600
For group operation only		
23000 & 34500	600	600

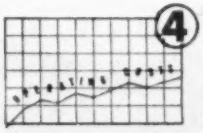
S&C ELECTRIC COMPANY

Formerly SCHWEITZER & CONRAD, INC. In Canada, Powerlite Devices, Limited, Toronto

give you Great Advantages:

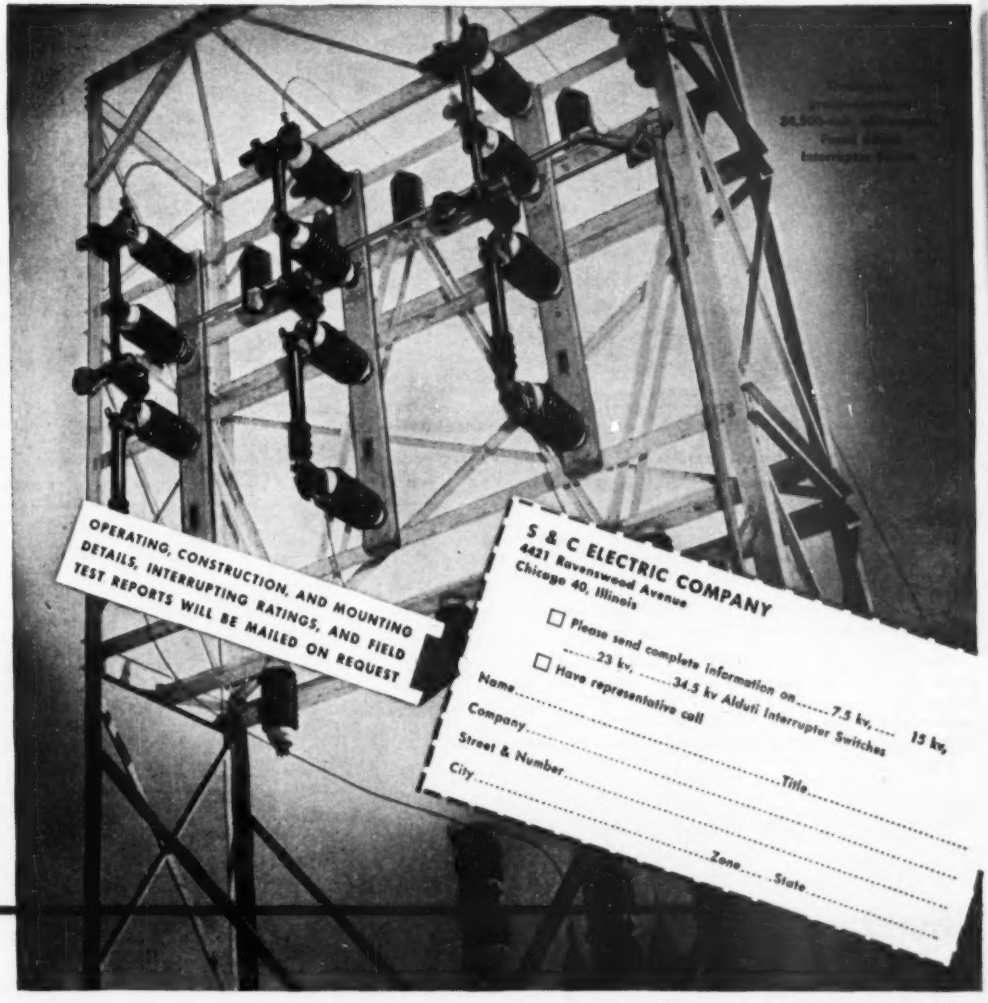
③ Where Structure Design Is Restricted

because horn gap switches can be mounted only in the horizontal upright position, and need wide phase spacings



④ Where Switching Sequences Are Complicated And Costly

because multiple operations—involving breakers, disconnects, and operating personnel— are required to isolate equipment or sectionalize circuits



OPERATING, CONSTRUCTION, AND MOUNTING DETAILS, INTERRUPTING RATINGS, AND FIELD TEST REPORTS WILL BE MAILED ON REQUEST

S & C ELECTRIC COMPANY
4421 Ravenswood Avenue
Chicago 40, Illinois

☐ Please send complete information on ..... 7.5 kv, ... 15 kv, ... 23 kv, ... 34.5 kv Alduti Interrupter Switches

☐ Have representative call

Name ..... Title .....

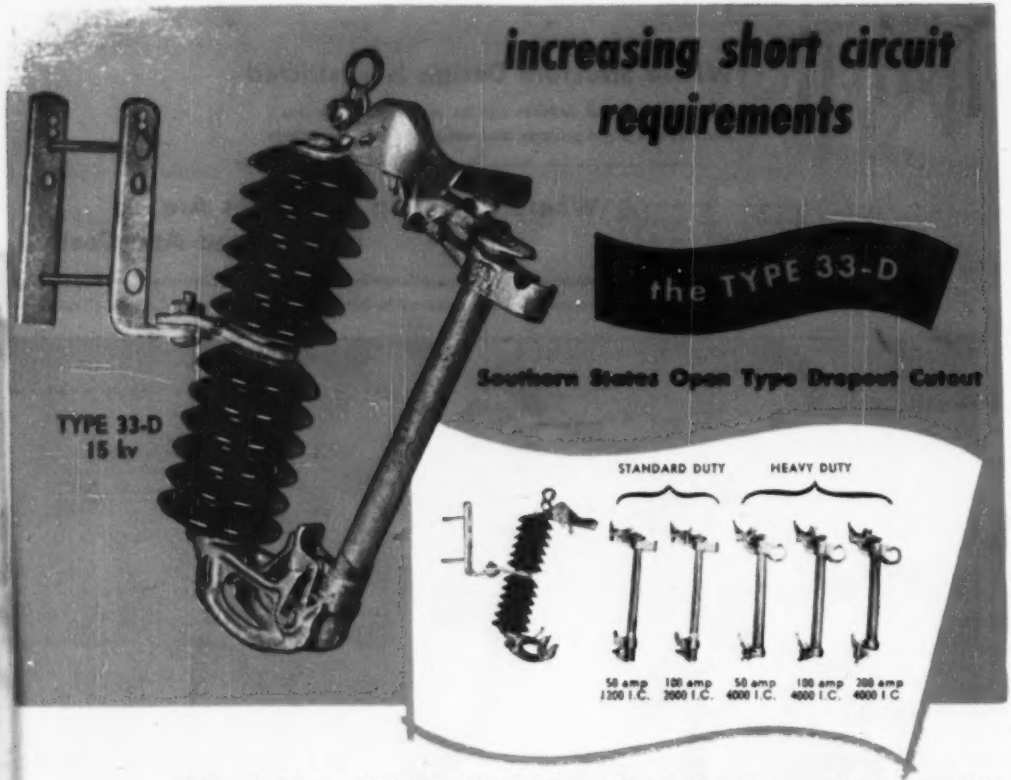
Company .....

Street & Number .....

City ..... Zone ..... State .....

VERSATILITY *that meets*

increasing short circuit requirements



Illustrated above is a 15 kv Type 33-D cutout mounting indicating the degree of interchangeability possible with this cutout. In a given voltage rating all fuse holders are mechanically interchangeable.

Fusing problems presented by increasing short circuit capacities point up the need for distribution cutouts that can be adapted for heavier duty—IN THE FIELD.

Southern States open type dropout cutouts, like the 33-D, meet these problems with interchangeable fuse holders.

Adding capacity to an installed Southern States cutout is a simple operation. By changing only the fuse holder and link the desired combination of continuous current and short circuit capacities can be obtained. For each cutout mounting of a given voltage rating, five fuse holders of different ratings are available.

CUTOUT RATING	MOUNTING CONTACT RATING	FUSE HOLDER RATING	
		CONTINUOUS	INTERRUPTING
kv	amp	amp	rms amp
5	100	50	1200
5	100	100	2000
5	100	50	4000
5	100	100	4000
5	200	200	4000
7.5	100	50	1200
7.5	100	100	2000
7.5	100	50	4000
7.5	100	100	4000
7.5	200	200	4000
15	100	50	1200
15	100	100	2000
15	100	50	4000
15	100	100	4000
15	200	200	4000

NOTE: When converting from a lower rating to 200 ampere rating, the brush contacts must also be changed.

Write for Bulletin No. 178-D

Southern States Equipment Corp.
HAMPTON GEORGIA

Advantages like these help you

Restore Service Faster!

Only FWD . . . the true 4x4 . . . offers you all these features that speed line work anywhere

Proper Weight Distribution

Only a true 4x4 gives you up to 40% of the weight on the front wheels. This gives you the extra traction needed to speed utility line work.

Full Torque P. T. O. . . . .

Utilizes full engine power through all transmission speeds. Exclusive safety lock prevents truck drive while boring.

High-Climb Oil Sump

Keeps oil pump constantly submerged. An FWD exclusive that lets you bore holes, set poles on steepest grades.

Two-Speed Aux. Transmission

Doubles the number of transmission gear ratios. Provides low gear ratio for full power at extreme low speeds in tough, cross-country operations.

Fully Compensated Drive

Three free-acting differentials compensate for differences in travel of all four wheels. Reduces drive line strains, eliminates needless tire scuffing.

Over 78 Matched Combinations of Trucks and Equipment

Now choose the exact mobilized tool that meets your requirements . . . and deal with only one source for complete service and supply.

DESIGNED WITH THE HELP OF VETERAN UTILITY MEN . . . FWD line construction and maintenance units handle your work . . . faster . . . safer . . . and at less cost. These mobilized tools get crews and equipment through to any location in spite of terrain or footing . . . speed work on the job . . . help maintain construction schedules or get service restored in a hurry. See your FWD dealer to get the facts on how FWDs can improve your service and earn more for each equipment dollar. The Four Wheel Drive Auto Co., Clintonville, Wisconsin. *Canadian factory*, Kitchener, Ontario.

Built by the makers of America's Foremost Heavy-Duty Trucks

Facts from KANSAS

"'CSP' Transformers cut failures to zero"

"Until a few years ago, our system was equipped 100% with conventional transformers. A particularly hot rural line was giving us considerable trouble, so we decided to make a test installation of 'CSP' Transformers comprising 160 stations," says a Kansas Utility.

"Accurate records had been kept for two years prior to installation of the 'CSP' Transformers and were also kept for the two succeeding years. The records show that of the conventional transformers, 45 had been damaged by lightning, and required 491 service trips for re-fusing.

"Of the 'CSP' Transformers, not one was damaged. Only 39 instances occurred where secondary breakers opened to protect the transformers from short-circuits or overloads. This record gave us good reason to adopt the 'CSP' Transformer for all future construction and replacement."

Installation and maintenance costs for Westinghouse "CSP" (Completely Self-Protecting) Transformers are always lower, because complete protective equipment is built in, not separately mounted. A two-year survey of Electric Light and Power Companies shows the following: J-70590

NATIONAL AVERAGES

	"CSP"	Conventional
Installation Costs	$13.87	$24.74
Burn-out Rate	0.257%	1.005%
Fuse Outages	None	5.64% @ $6.52 per outage
Load Checks	Automatic	12.8%
Breaker Reset	1.02%	None

If you'd like to check your own costs against these national averages, ask your Westinghouse representative for Booklet 4-247-B, "Transformer Costs and Their Relation to Profits", Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

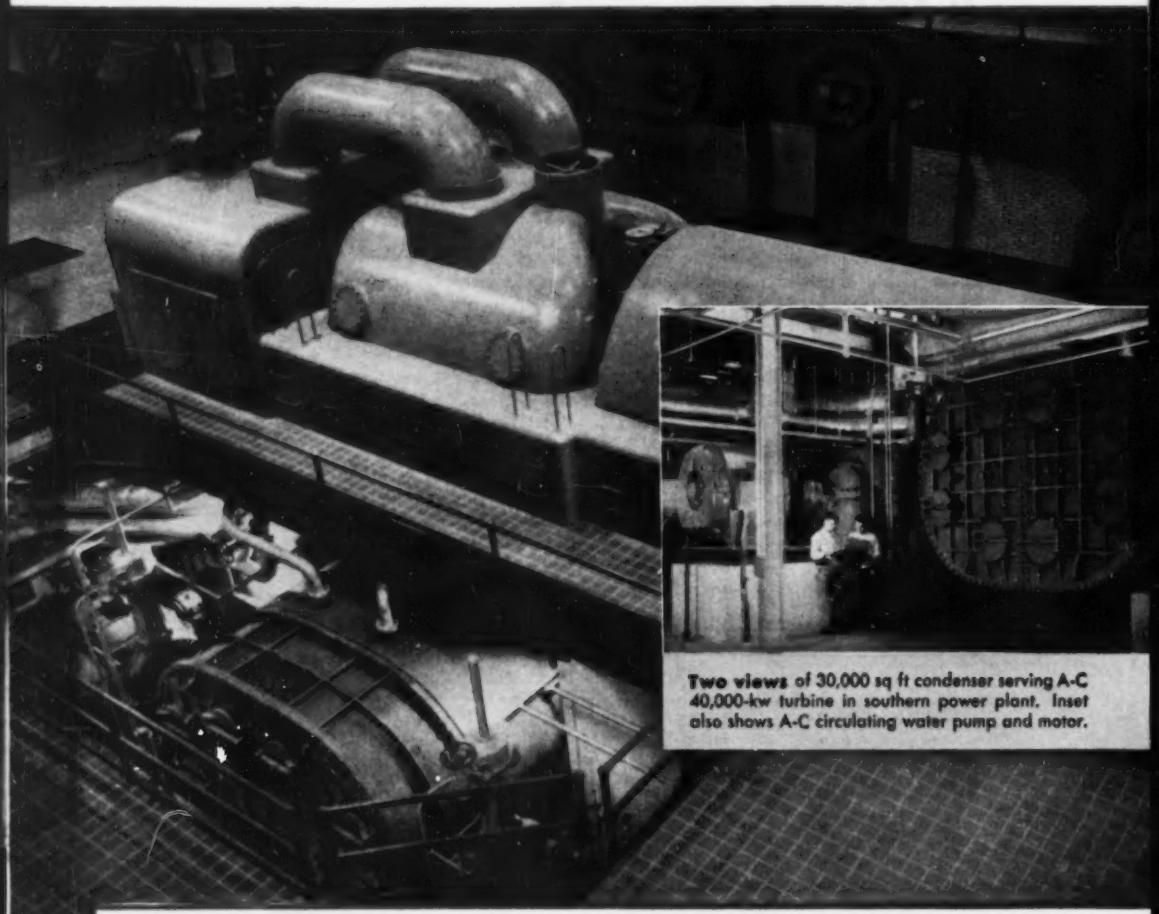
"CSP" devices . . . originated and patented by Westinghouse.

YOU CAN BE SURE... IF IT'S

Westinghouse

"CSP" DISTRIBUTION TRANSFORMERS

THE CONDENSER THAT CUTS



Two views of 30,000 sq ft condenser serving A-C 40,000-kw turbine in southern power plant. Inset also shows A-C circulating water pump and motor.

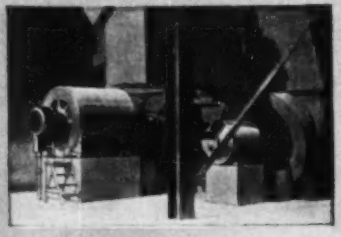
Equipment for Power: Water Conditioning equipment, chemicals and service . . . Steam and Hydraulic Turbines . . . Generators . . . Condensers . . . Steam Jet Air Ejectors . . . Power Plant Pumps and Motors . . . Transformers . . . Circuit Breakers . . . Switchboards and Control . . . Switchgear . . . Unit Substations . . . Utilization equipment.

ALLIS-

IT PAYS TO KEEP PACE WITH MACHINERY PROGRESS

Motors That Are at Home Outdoors

Open sky is roof enough for Allis-Chalmers *tube-type* totally-enclosed fan-cooled motors. Tube-type air-to-air heat exchanger construction makes large ratings practical. Time-proved design is practically self-cleaning, cuts maintenance costs.



POWER COSTS

3 WAYS

WITHOUT SURFACE CONDENSERS, low-cost steam-generated electric power would not exist. By maintaining a vacuum at the turbine exhaust, condensers increase plant efficiency and power output. By condensing steam for reuse, they minimize feedwater requirements and costs.

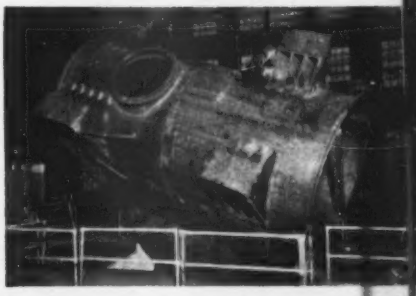
In installation after installation, Allis-Chalmers condensers have given outstanding performance. They are tailor-made for each particular installation. They incorporate design features that provide continuous unbroken operation. And they have consistently cut power costs by maintaining:

1. **Lowest practical absolute pressure obtainable with the water temperature available.**
2. **Highest "terminal-difference" efficiency; that is, the temperature of the cooling water leaving the system most nearly approaches the temperature of the steam in the condenser.**
3. **Highest possible condensate temperature.**

The engineering behind these cost-cutting, multi-steam-path condensers results from more than 60 years of condenser building experience. Since the days of the early steam engines, Allis-Chalmers has produced more than 13,000,000 sq ft of condenser capacity — for all areas of the country and for all types of water conditions.

Whether you need a 500 sq ft or a 100,000 sq ft condenser, you can benefit from this experience — and from A-C's unexcelled manufacturing facilities. Why not discuss your requirements with your nearby A-C representative. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3813

Adequate manufacturing facilities assure accurate machining and assembly. Here, a 40-ft mill easily handles end section of a 75,000 sq ft condenser.



Special welding positioner produces sound welds by permitting operator to work in natural position.

Drilling bolt holes in flange of large oval shell section requires modern facilities so parts will fit precisely.

CHALMERS A-C ALLIS-CHALMERS

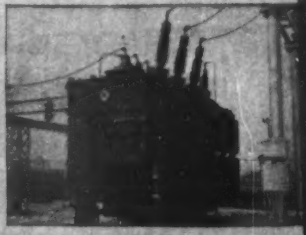
Ask your A-C representative for Bulletin 1986784, which shows how Allis-Chalmers builds these cost-cutting condensers.

First Generator with Supercharged Cooling

In this operation-proved turbine-generator, *supercharged* hydrogen passes through rotor conductors. *Supercharging* increases output per unit size . . . cuts foundation costs, plant size, and breaker and bus structure requirements.

Transformers with Corona-free Design

To check insulation aging, A-C transformers are designed to be corona-free even at highest test voltages. Without corona, your transformers stay young; repeated voltage stresses do not cause progressive deterioration of insulation.



CRYSTAL VALVE'S *SUPER-SPEED* MEANS *SUPER-SAFETY*

Gap Structure Assures Low Impulse Sparkover

A series of small spark gaps instead of a single large gap electrodes which discharge between smooth flat surfaces accurately ground Steatite spacers between gap electrodes these are features in the Crystal Valve spark gap assembly which guarantee high speed uniformity reliability and efficiency.

Crystal Valve's super-speed means low sparkover or relief voltage and low internal impedance high protection to apparatus insulation. Ventilated spark gap types prevent corrosion glass body types make gap inspection easy.

Install Crystal Valve Arresters on every transformer for fullest protection and year-round dependability.

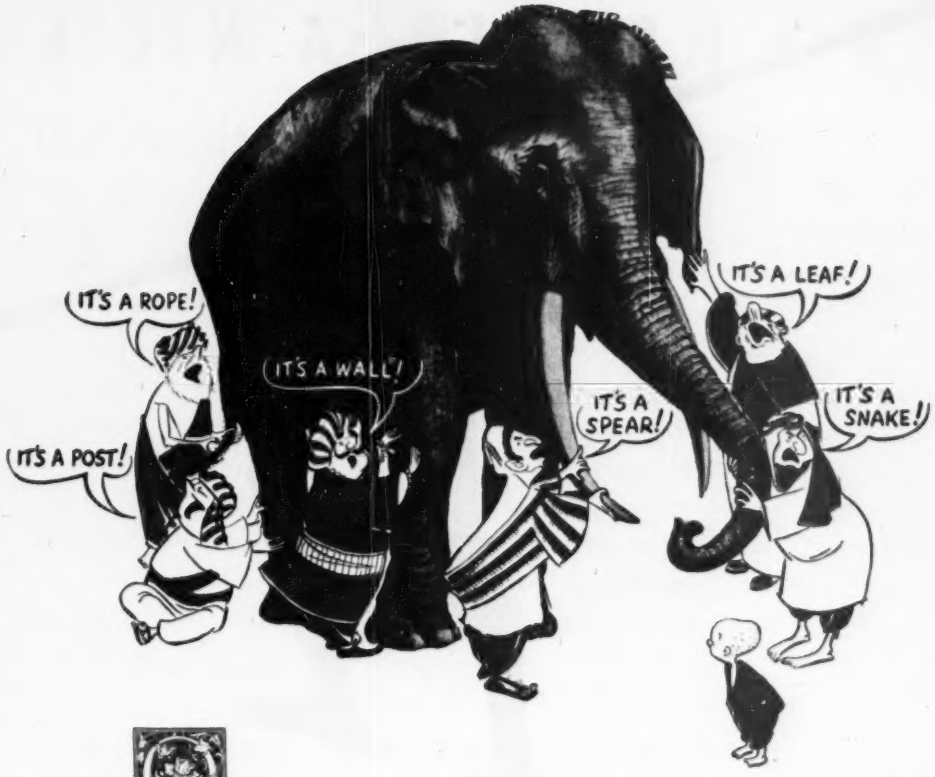
Write today for latest data on lightning arresters and their installation. Ask for CV catalog.

CRYSTAL VALVE

LIGHTNING ARRESTERS

ELECTRIC SERVICE MANUFACTURING CO., PHILADELPHIA 32, PA.

Represented in Canada by Lyman Tube and Bearing, Ltd., Montreal and Toronto



ONCE upon a time there were six blind men, each of whom touched a different part of an elephant's body and came up with six different descriptions of it.

It might be well to remember this when considering the purchase of transformers. Unless the manufacturer considers the product's purpose objectively, it is quite possible that over-all performance will be sacrificed. Unbalanced design will not produce the efficient distribution system you are seeking.

Moloney products are designed and produced with your needs in mind. Over 50 years of experience in engineering, research, design and fabrication are combined to produce the best all-around transformers that you can buy. For better performance, greater reliability and less maintenance . . . specify Moloney.

ME-52-01

MOLONEY ELECTRIC COMPANY

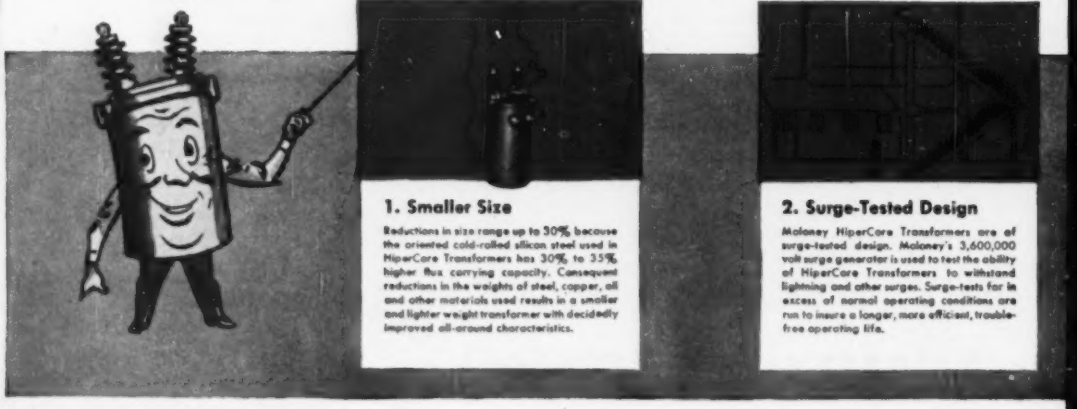
Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = { BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

BALANCED

HiperCore 4 point superiority for Balanced Performance



1. Smaller Size

Reductions in size range up to 30% because the oriented cold-rolled silicon steel used in HiperCore Transformers has 30% to 35% higher flux carrying capacity. Consequent reductions in the weights of steel, copper, oil and other materials used results in a smaller and lighter weight transformer with decidedly improved all-around characteristics.

2. Surge-Tested Design

Maloney HiperCore Transformers are of surge-tested design. Maloney's 3,600,000 volt surge generator is used to test the ability of HiperCore Transformers to withstand lightning and other surges. Surge-tests far in excess of normal operating conditions are run to insure a longer, more efficient, trouble-free operating life.

FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

PERFORMANCE

. . . the result of skill and experience

IT looks so easy! But . . . you know it's not! This fellow has to keep his mind on his work and walk a straight line. So it is with a transformer . . . it must keep working day and night. It must operate efficiently under normal conditions in addition to being able to handle overloads, surges, and what have you, without an interruption of service . . . in short, *balanced performance.* Thus *balanced performance* cannot be achieved when one feature is emphasized at the expense of other features. Therefore, it would be well to check all the features of a transformer to be sure that it will perform as you want it to . . . *continuously* and *efficiently.* We feel that such precaution will result in the selection of Moloney HiperCore Transformers for your distribution system.

MEDO-12

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

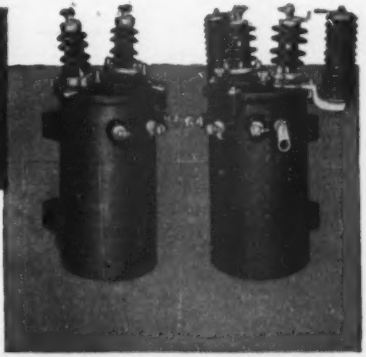
SAINT LOUIS 20, MISSOURI

3. Greater Short-Time Overload Capacity

Moloney HiperCore Transformers have improved short-time overload characteristics which provide better peak load performance and longer life. Reduced coil mass, achieved through use of oriented steel cores, together with the extensive use of cooling ducts, results in more rapid cooling of the windings and in a lower hottest-spot temperature gradient.

4. Better Voltage Regulation

The smaller cores of HiperCore Transformers make possible windings having lower impedance. Lower impedance provides lower internal voltage drop at all loads. This is especially important during peak load periods, since HiperCore transformers can carry higher overloads than older types, at the same permissible regulation.



MOLONEY ELECTRIC = { BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES

How Mallory Contact Assembly facilities can help you ...and cut costs

If you are now designing and manufacturing your own electrical contact assemblies, Mallory assembly engineering can simplify your production problems. Here's a typical example of how Mallory saves manufacturers time, trouble and money.

The components of this contact assembly for an aircraft power control unit formerly had to travel a complicated path between many suppliers. First, a copper blank was purchased from one source and sent to Mallory for brazing of the contact. Plate and braid, from another supplier, went with the brazed blank for assembly brazing in a fourth shop. A fifth supplier silver-plated the assembly.

Mallory now produces the complete assembly from start to finish. Quality is higher, and production costs are lower. The customer's problems of scheduling, reshipment, storage of components and divided responsibility are entirely eliminated.

EXPECT MORE...GET MORE FROM MALLORY

Here's what Mallory has to offer on your contact assembly work:

DESIGN EXPERIENCE . . . based on Mallory's engineering of more than 5000 types of contacts.

SPECIALIZED METALLURGICAL KNOWLEDGE . . . through consistent leadership in the development of powdered metals and special alloys for electrical contact service.

ADVANCED TECHNIQUES . . . for spot welding, brazing to provide full-area bonding of the contact to the backing material, and other specialized assembly methods which cut manufacturing costs and improve performance.

COMPLETE PRODUCTION FACILITIES . . . a recently expanded plant geared to high production and prompt delivery.

It will pay you to investigate Mallory assembly engineering, whether your contact assemblies are now in production or still on the drawing board. Write to us today.

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

P.R. MALLORY & CO. Inc.

MALLORY

SERVING INDUSTRY WITH THESE PRODUCTS:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
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Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO., INC. INDIANAPOLIS 6, INDIANA

High-voltage capacitors now assembled in completely wired, factory-assembled stacking units

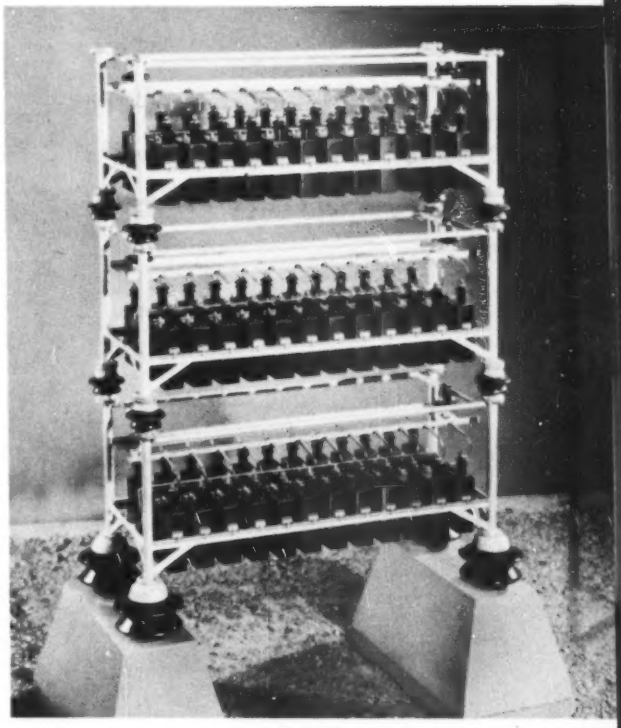
INSTALLED COST GREATLY REDUCED

The use of capacitors has long been accepted as the most economical means of improving voltage conditions and increasing circuit capacities. Now, Westinghouse offers a line of *standardized factory-assembled* capacitor stacking units from which can be selected the appropriate combination to achieve desired KVAR and voltage ratings. The result is a minimum of installation labor and expense.

The new outdoor capacitor stacking units can be arranged for service from 2,400 to 287,000 volts, through groups of standard rating units connected in series between line and neutral. The capacity will depend on the number of units in parallel per group. Unit construction provides the important advantages of low-cost installation, plus easy reconversion for other voltages . . . and you can stack them up to four units high.

Long maintenance-free life of the complete unit is assured by hot-dip galvanizing of the steel framework *after assembly*. The zinc-spray finish of the capacitor units eliminates any need for periodic painting.

For complete information, write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.



Typical Westinghouse high-voltage capacitor bank. Each of the three stacking units is completely assembled and wired, and shipped ready for installation.

YOU CAN BE SURE... IF IT'S

Westinghouse

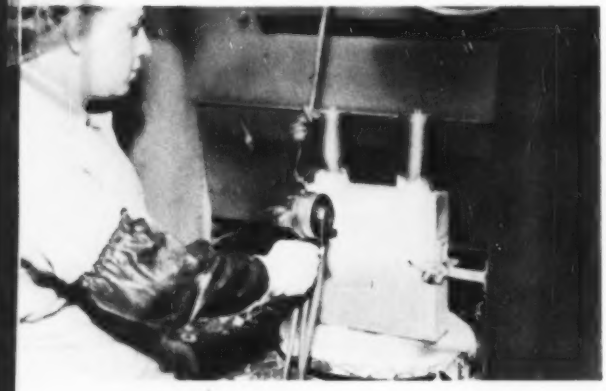
INERTEEN CAPACITORS

Better service, greater savings . . . result from these design and construction features

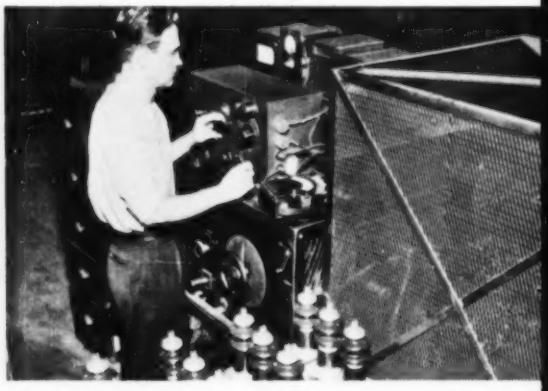
The steady reduction in Westinghouse capacitor price is supplemented by the large savings realized from lower installation and maintenance costs. Westinghouse Inerteen* Capacitors have compiled an enviable record of long-life, trouble-free service. These features are typical of the way Westinghouse engineering keeps your costs low.

Inertex paper dielectric—Inertex is a special Westinghouse capacitor paper of highly purified wood cellulose. It is rigidly inspected for conducting particles, and physical, chemical and electrical characteristics. Non-inflammable Inerteen is used for impregnation.

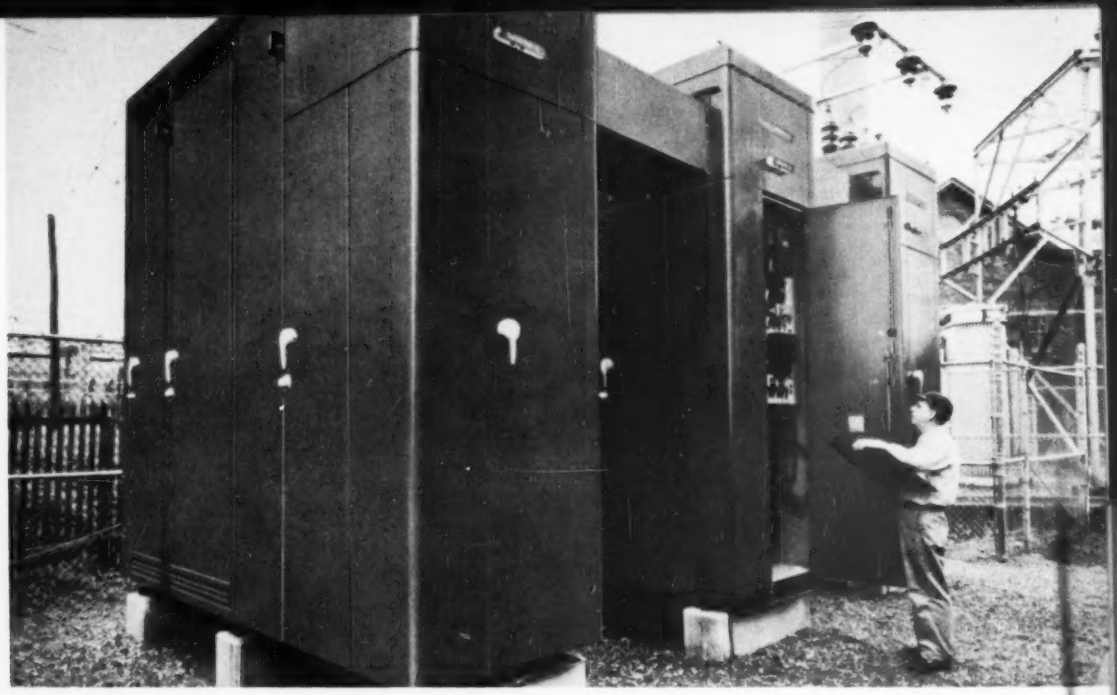
Hermetically-sealed units—Solder-sealed terminal bushings eliminate compression gaskets, give positive protection against leaks or contamination of the dielectric assembly.



Zinc-spray finish—A tough zinc coating, many times the thickness of normal hot-dip galvanizing, gives effective protection against rust and atmospheric corrosion, provides strong resistance to abrasion.



Testing—All known operating conditions are included in performance tests given to every Inerteen Capacitor. Electrical tests assure losses of not more than ⅓ of 1% . . . full kvar at rated voltage and frequency. Pressure tests insure leakproof construction.



For system voltage control from large substation banks . . . Westinghouse completely enclosed capacitor equipments

Westinghouse metal-enclosed capacitor equipments are used primarily in large substation banks to control voltage levels and reactive power flow over whole systems. This 13.8-kv 3-phase unit includes capacitors, circuit breakers and grounding switches for complete automatic or manual control. Available in a voltage range of 230 to 34,500 volts. They offer these built-in time and money-saving advantages:

Factory-assembled enclosures—Low installation costs follow from simple foundation requirements, easy connections.

Completely self-contained—Up to 13.8 kv, they are integral operating units, and require *no* external accessories.

Complete safety—Safety to personnel and equipment is assured by fully interlocked system of grounding control. Completely encased in steel.

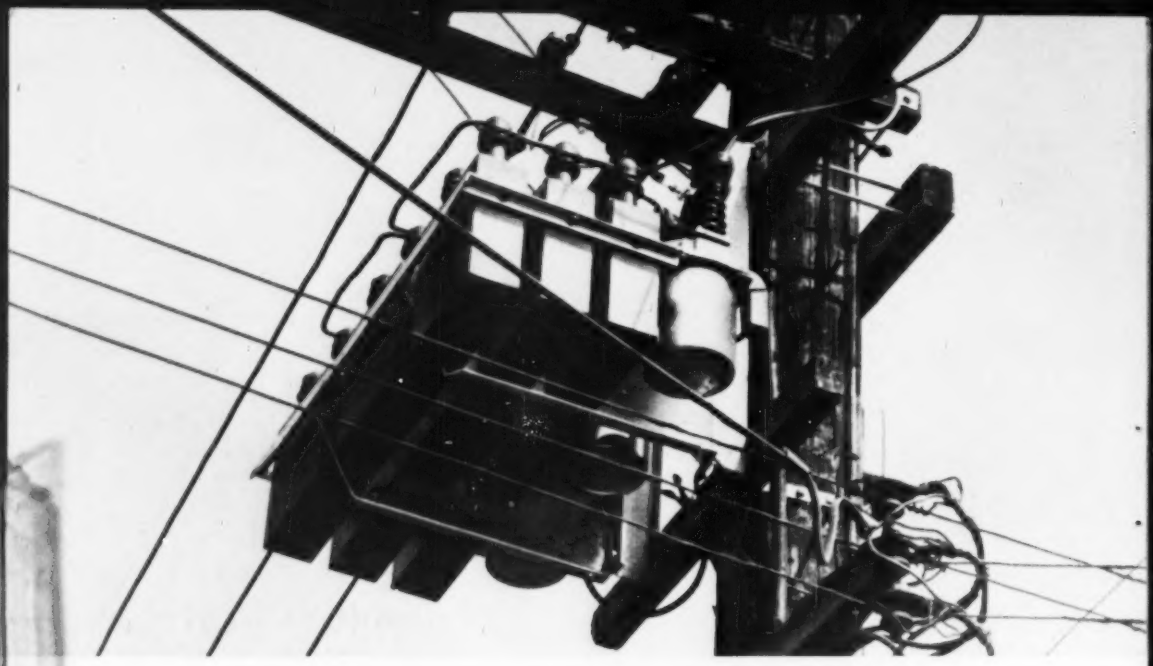
Compact structure—Minimum floor space required.

Wide flexibility—Roof bushings, throat, or pothead connections provide for easy installation. Easily moved to new location.

•

Westinghouse Enclosed Capacitor Equipments are available with automatic control, where operating conditions require. For more information on how you can increase pay loads with Westinghouse capacitors, contact your local representative, or write for Booklet D.B.49-220. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

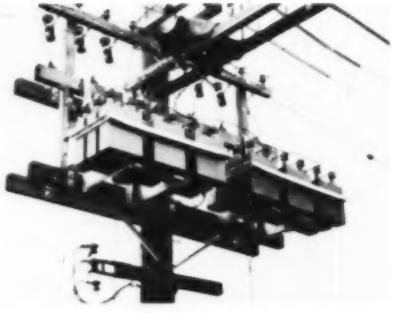
YOU CAN BE **SURE**...IF IT'S Westinghouse



Automatically switched Autotrol* brings low-cost capacitor equipment to distribution circuits

Westinghouse Open-Type Autotrol turns power-factor losses into profitable pay-load capacity . . . at a cost as low as $5.66 per kvar. Compact, lightweight Autotrol units are completely factory assembled and wired . . . installation is simple and inexpensive. You just hoist, bolt and connect! Available for 225 and 300 kvar, Autotrol answers your need for "on-the-spot" switched power-factor improvement at any point on your distribution system.

Your Westinghouse representative has more complete information on the savings you can effect. Or write for Booklet D.B. 49-310. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60796



YOU CAN BE SURE...IF IT'S

Westinghouse

INERTEEN CAPACITORS

*Trade-mark

REMEMBER THIS

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.

The Bartlett Way

SCIENTIFIC TREE CARE . . . gets to the root of tree trouble

Skill replaces guesswork when Bartlett takes care of your trees. Tree life, tree health, tree diseases, tree enemies are too complex to be understood thoroughly by any but those qualified by study, training and experience.

Fine shade trees are an investment, but one that can appreciate or depreciate depending on the care that is given them. Like any investment they must be jealously guarded in order to derive the greatest return in value and enjoyment. Of all the priceless possessions with which nature has endowed mankind, trees are the most spectacular . . . a miracle of living beauty revisited each year. Trees are the heritage for all mankind, for young and old, for rich or poor, in every land, to enjoy, to use, to appreciate.

But the most important trees are your trees. That's why the best care you can give your trees is the Bartlett Way. The achievements of the Bartlett Way are not accidents. They represent the result of many years of painstaking research and experiments by the Bartlett Tree Research Laboratories. Each and every process, technique, material and tool used in Bartlett tree care is the result of cumulative years of knowledge and experience, of study and development. It is the Scientific Way . . . that gets to the root of all tree trouble.

BARTLETT TREE EXPERTS Stamford, Conn.

Branch Offices: Rutland, Windsor, Vt.; Concord, Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Osterville, Pittsfield, Prides Crossing, Mass.; East Providence, R. I.; Danbury, Hartford, New Canaan, New Haven, Stamford, Westport, Conn.; Delhi, Islip, Kingston, Monroe, Middletown, New York, Southampton, Syracuse, Westbury, White Plains, Yorktown Heights, N. Y.; Bernardsville, Morristown, Orange, N. J.; Chambersburg, Ligonier, Paoli, Phila. (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Portsmouth, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Bluefield, Charleston, Huntington, W. Va.; Kingsport, Tenn.

to the executive who could use more days in a month

With your present staff already operating full-time on regular assignments, how often have you wished there were more days in a month to take care of the special problems which arise in your business?

One way to get more executive-days per month is to make use of the services of an outside consulting firm such as EBASCO. Many companies have learned from experience that such a course of action usually leads to substantial savings in executive time and energy—permits their own top men to continue functioning at maximum efficiency on regular work.

Because of its continuing relationships with many and diversified industries, its knowledge of all kinds of business situations, and its contact with important new developments, EBASCO is well equipped to handle your special problems . . . whether they involve corporate finance, systems and methods, space planning, industrial relations, taxes, insurance or sales and marketing.

Regardless of the size of your firm or the scope of your business problem, EBASCO engineers, constructors and business consultants can render your company prompt and efficient service.

For a full story of EBASCO's scope of operations, write for your free copy of "The Inside Story of Outside Help." Address: Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

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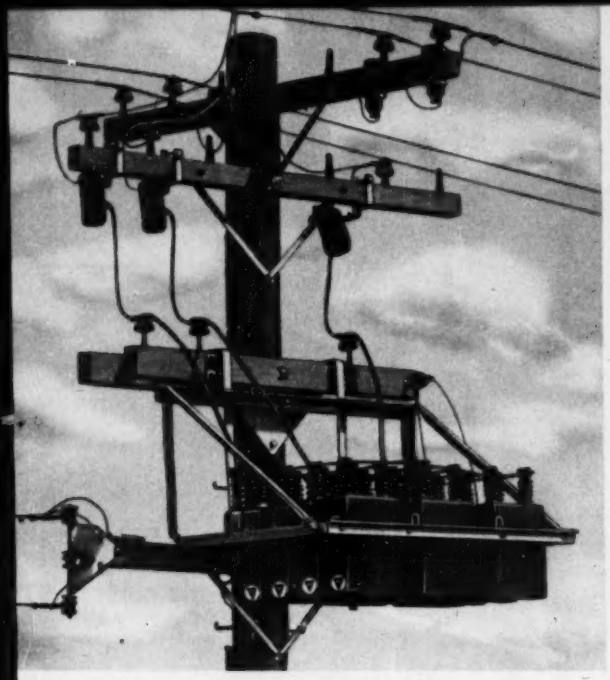
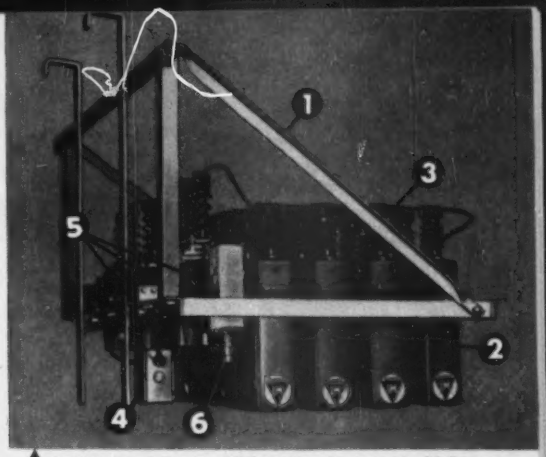


A 300 kvar switched capacitor rack serving a suburban area. Note the simple, compact arrangement and accessibility of the entire assembly. Wiring is completely bird-proof.



▲ Details of the L-M racks. (1) Rugged angle steel rack. (2) Elemex Capacitors. (3) Neoprene-covered wiring with Neoprene terminal caps. (4) Weatherproof terminal box for low voltage control wiring is easily accessible. (5) L-M Type NR oil switches. (6) Weatherproof plug-in connection to switch.

New and Exclusive Oil Switch Plug-In Connection Simplifies Maintenance

A weatherproof plug-in connection and weatherproof plug at the base of the oil switch control housing permits the switch to be disconnected without disturbing any of the low voltage wiring. Only one easy-to-reach connection to break and the switch is ready to be removed for service. It's so simple that the three switches can be disconnected in less than a minute.

L-M's Open Rack Capacitor Assemblies Are Completely Wired To Save Linemen's Time

by **HAROLD T. ZAMZOW**, Manager, Capacitor Sales, Line Material Company

With completely assembled capacitor racks, wired at the factory, the cost of installation of either switched or unswitched banks is greatly reduced. This becomes a major factor when one considers both installation costs and the availability of capable linemen.

Bird-Proof Wiring

L-M's racks are mounted in strong angle-steel frames, and provided with lifting lugs. All high voltage connections are made with ¾" Neoprene-covered conductor. Bushings are covered with unbreakable Neoprene terminal caps. This provides an absolutely bird- and squirrel-proof assembly.

Switched or Unswitched Assemblies

Assemblies may be switched or unswitched. Switched racks are provided with L-M's motor-operated "NR" oil switch in each phase. These are electrically interconnected to give three-phase operation. Control connections are made to a weatherproof terminal box mounted in the rack. Only simple, low-voltage wiring is necessary. For control, L-M's Type CCV voltage-sensitive control is suggested. This control can be adjusted in the field without test equipment. Time clocks or pilot control also may be used.

Fully Tested and Guaranteed

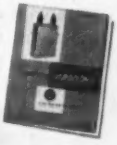
Elemex Capacitors are 100% tested during and after manufacture, and the completely wired assembly, including switches, is thoroughly retested and guaranteed. Thus the operator using these assemblies is assured of dependable operation, with an appreciable saving in overall costs.

Available in Various Assemblies

L-M's completely wired capacitor assemblies are available in 5 kv and 15 kv racks up to 300 kvar switched or 375 kvar unswitched. Total cost of switched banks is as low as $5.66 per kvar, and unswitched banks as low as $4.52 per kvar, completely wired!

Get Full Information

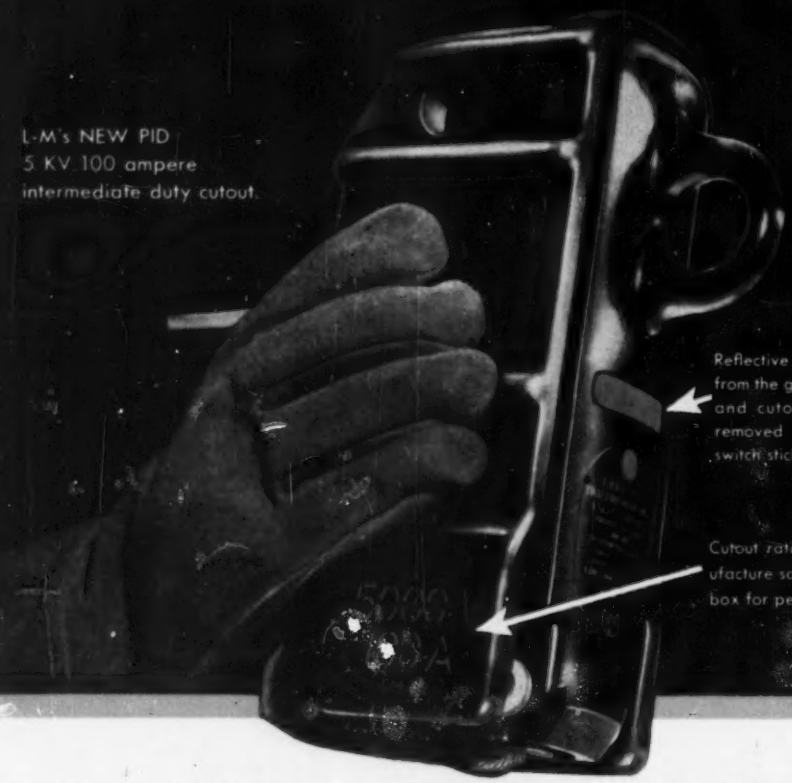
For full information on ELEMEX Capacitors and L-M's completely wired assemblies, ask the L-M Field Engineer; or write Mr. Zamzow at Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



LINE MATERIAL 104

Elemex Capacitors

Complete Coordinated Equipment for Distribution Today


L-M's NEW PID
5 KV 100 ampere
intermediate duty cutout.
Reflective markings easily seen from the ground identify the door and cutout. Doors are easily removed and replaced with a switch stick, for safety.
Cutout rating and date of manufacture sandblasted into side of box for permanent identification.

L-M's New PID Cutout Provides Up To 166% Higher Interrupting Capacity At 20% Lower Cost

Costs 20% less than standard 100 ampere cutout; interrupting capacity 166% higher at 2.5 kv (8000 amperes), 66% higher at 5 kv (5000 amperes). Box will accept all standard 50 ampere doors, thus permitting one box to be used for both 50 and 100 ampere service. Also takes 200 ampere switch blade door.

L-M's PID Cutout is designed to provide a 100 ampere intermediate duty cutout at an appreciable saving over standard 100 ampere cutouts. Boxes are smaller and more compact than standard 100 ampere cutouts—they are the same size as a 50 ampere cutout but terminals and contacts are heavier. Thus the cutout will take any of L-M's 50 ampere doors, as well as the 100 ampere intermediate duty and 200 ampere switch blade door.

The non-disconnecting door provides positive link ejection and circuit interruption even on low current faults.

Both cutout and switch blade doors can be removed and replaced with standard switch sticks, providing additional safety.

Cutout and disconnect switch doors are easily identified from the ground by the reflecting markings on the doors. Rating and date of manufacture are sandblasted into sides of box for permanent identification.

Get Details on L-M Fuse Cutouts

L-M offers complete families of open and closed type cutouts to meet a wide range of requirements. Interchangeable doors offer low first cost and economical capacity increases as loads are increased. For complete information ask the L-M Field Engineer or write for bulletins. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

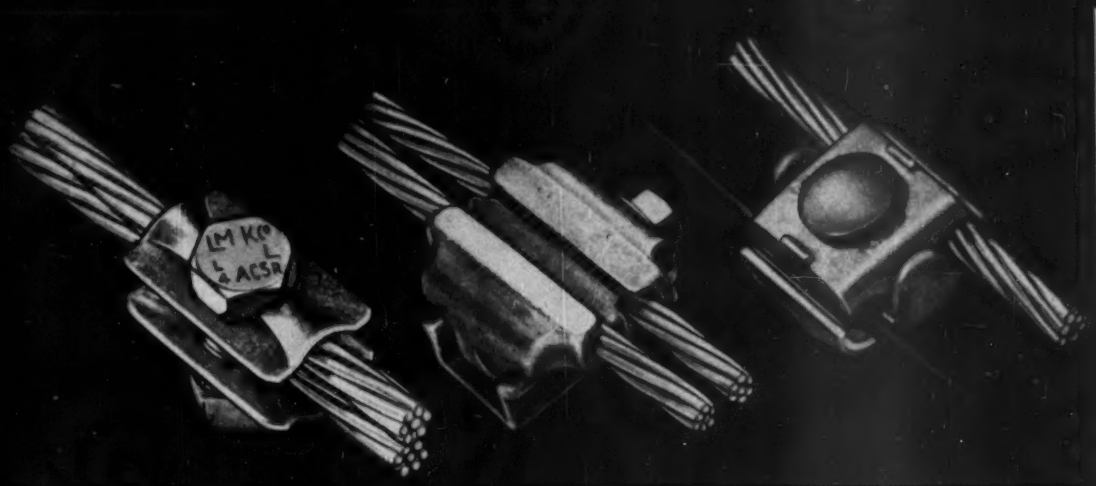
LM

LINE MATERIAL

fuse cutouts

103

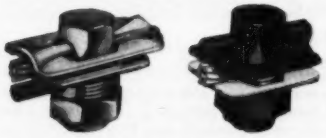
Complete Coordinated Equipment for Distribution Today



ONLY L-M Offers All 3 Types of Connectors for Aluminum

1–SPLIT BOLT

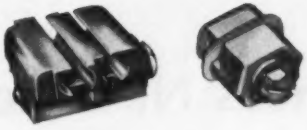
For Al to Al: Type AA, left, is plated bronze with two aluminum washers. For #2 to 4/0 solid; #4 to 4/0 ACSR. Type PB, right, is a plated bronze connector with plated spacer bar. Sizes from #2 to 4/0 solid aluminum; #4 to 4/0 ACSR.



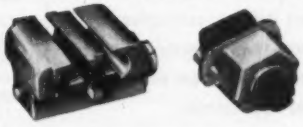
For Al to Cu: Type AC, left, is plated bronze with one aluminum and one bimetal washer. Five sizes, for #2 and 1 solid, #4 to 4/0 ACSR, and #2 to 4/0 solid copper or #3 to 4/0 stranded copper. Type CA, right, has a bronze body with two bimetal washers. In a full range of sizes from #6 solid aluminum to #4/0 ACSR, and #6 solid copper to #4/0 solid or stranded.

L-M Split Bolt and Fargo Vise-Type Connectors fully meet new standards of the Electrical Service Connector Institute.

2–VISE TYPE



For Al to Al: The famous Fargo vise-type connectors provide wide contact surfaces and massive design for greater heat dissipation; always threaded; no loose parts. At left, No. 9000-3, for sizes up to and including 397,500 Al; No. 9000-1, right, for #4 ACSR and smaller.



For Al to Cu: The vise-type principle in cast alloy with bimetal inserts, for aluminum to copper connections. No. 9000-4 at left is for sizes up to and including 397,500 Al. No. 9000-2 at right is for #4 ACSR and smaller.

3–CLAMP TYPE

For Al to Al: One-Bolt Parallel Groove Clamp, No. CL10X, for Al to Al connections. Clamp casting is aluminum, with galvanized steel square shank bolt, washer, and nut. For ACSR #6 to 4/0, #4 to 1/0 armored.

For Al to Cu: One-Bolt Parallel Groove Clamp, No. CL10X, same as above, except that copper liners are brazed to aluminum body on tap side. For copper taps #12 to 2/0. Also in all bronze for copper-to-copper connections.

Ask L-M's Connector Headquarters for Information

Years of research and development by L-M Engineers assure the best connectors and a full range of types for aluminum, copper, and combinations. See the L-M Field Engineer or write for bulletin. Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL Connectors

Complete Coordinated Equipment for Distribution Today

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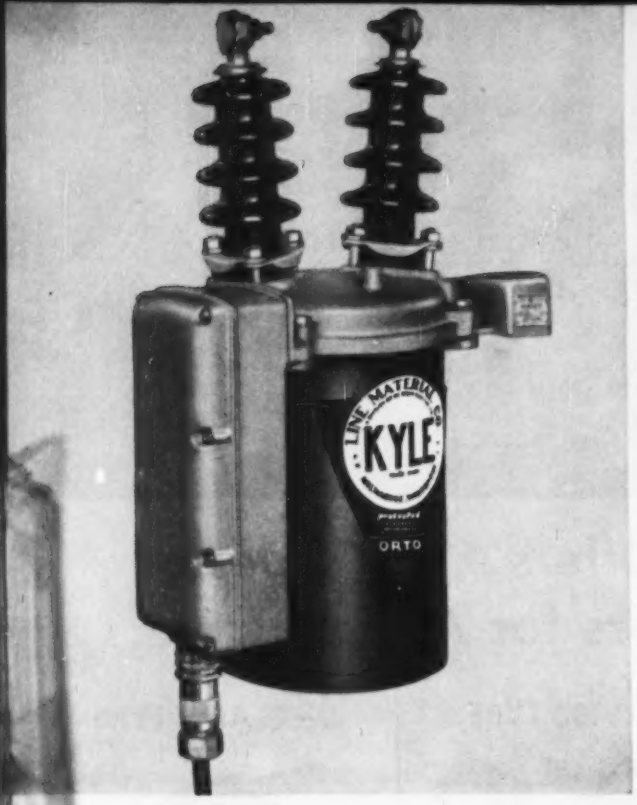
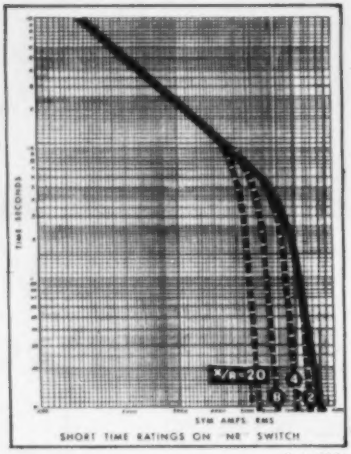


L-M's Kyle Type "NR" remote control oil switch—the same switch used in L-M's switched capacitor racks.

"Field-Designed"—with the features users asked for.

200-amperes nominal load rating at 14.4 kv, 150 amperes for capacitor switching. 9000 amperes RMS asymmetrical momentary current rating.



SHORT TIME RATINGS ON NR SWITCH

Data 235A

L-M Announces New Remote Control Oil Switch for Capacitor Switching

Here is L-M's new motor-operated 200-ampere remote control oil switch. It is specially designed for low-cost capacitor switching up to 3500 kvar 3-phase, but is equally suitable for street lighting, flood and airport lighting, protective lighting, sectionalizing, and other remote control switching applications. Ratings meet users' needs and requirements for capacitor switching and many other applications.

The contact structure is so designed that heavy currents increase contact pressure and give the switch high momentary and short-time current ratings. Spring-loaded contacts give very fast "make" and "break"—which eliminates restrikes and minimizes contact erosion when closing in on large capacitor banks.

The switch can be bolted directly to the pole, or crossarm with a thru-bolt or crossarm-mounted with a clamp-around hanger. Clips also available for mounting on substation steel structure.

Control motor requires less than one ampere at 120 volts, which permits the lightest wiring, simpler control circuit, and gives longer life for limit switches and relays.

Get Full Information

Ask the L-M Field Engineer for details on this new Type NR Switch—or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

Type "NR" Switch Ratings

SINGLE PHASE

VOLTAGE

Nominal	RMS 14.4 kv
Maximum design	RMS 15.0 kv
60 cycle, one minute withstand, dry	RMS 35.0 kv
60 cycle, ten-second withstand, wet	RMS 30.0 kv
1½ x 40 Ms impulse withstand, crest, BIL	95.0 kv

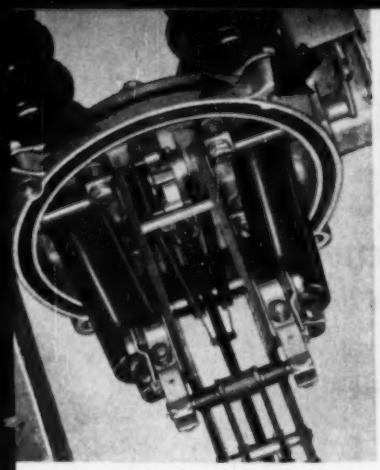
CURRENT

Thermal	200 amperes
Capacitor switching, nominal	150 amperes
Inductive load switching,	
75 to 100% PF	200 amperes
50 to 75% PF	100 amperes
Less than 50% PF	50 amperes
Momentary, RMS Asymmetrical	9000 amperes
Short-time, RMS Symmetrical	
10 seconds	1400 amperes
1 second	4500 amperes

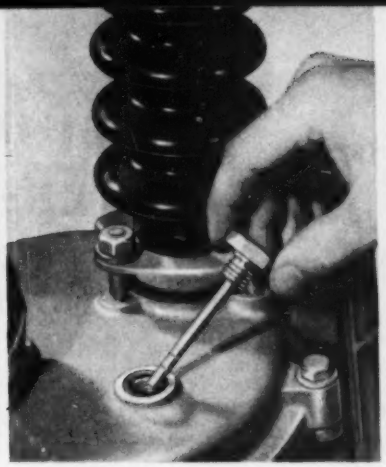
For larger ratings at shorter time intervals see curve, Data 235-A above.

CONTROL

Motor-operated actuator requires less than one ampere at 120 volts. Permits simplest control circuit and gives long life of limit switches and control relays.

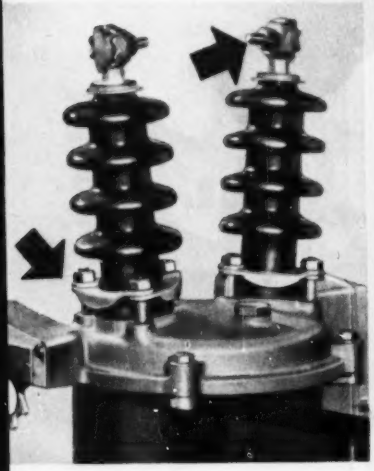


Head may be rotated and set at desired position. Lips in the groove on the underside of head hold the gasket so that it doesn't fall out when the cover is lifted.

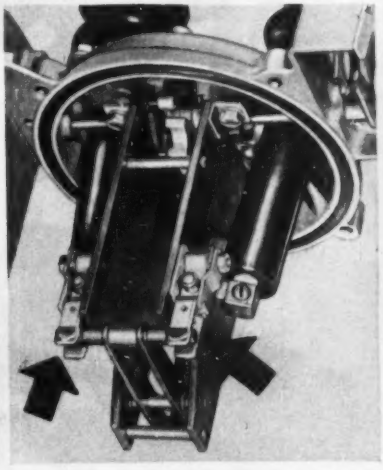


Oil dip stick on the head for checking the oil level. The tank holds 1½ gallons of oil. The inner mechanism is insulated from the tank by the oil and by a tank liner.

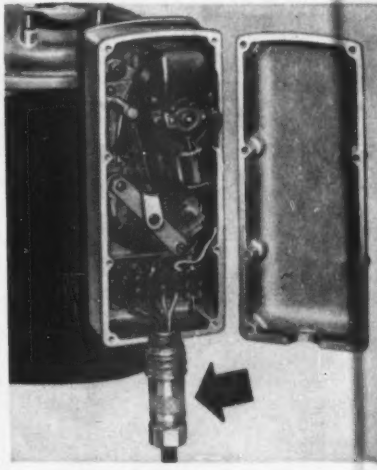
Heavy bracket for direct mounting to pole or crossarm with or without a hanger. Heavy tank, with inserted concave bottom, so that only the rim takes abrasion.



The bushings are the clamp-on type which make replacement easy. Bushings are oil-filled for lowest radio noise level. Plated Universal terminals for aluminum or copper conductor, No. 8 to 2/0.



Contacts arranged so heavy currents increase contact pressure, giving high momentary and short time current ratings. Spring-loaded contacts give quick make and break to prevent restrikes and minimize erosion.



Motor-operated actuator requires less than one ampere at 120 volts, permitting lighter wiring and simplest control circuit, and assuring long life for limit switches and relays. Weatherproof plug-in connection at bottom of box and weatherproof plug available.

CAPACITOR SWITCHING RATING

Voltage	Based on 25 KVAR Units				Based on 15 KVAR Units			
	Three-Phase		Single-Phase		Three-Phase		Single-Phase	
	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units
2400	600	24	350	14	585	39	360	24
4160	1050	42	625	25	1080	72	615	41
4800	1200	48	725	29	1215	81	720	48
7200	1800	72	1075	43	1845	123	1080	72
12470	3225	129	1850	74	3240	216	1860	124
13200	3375	135	1975	79	3420	228	1980	132
13800	3525	141	2050	82	3555	237	2070	138

LINE MATERIAL

Kyle® Oil Switches

Like all Kyle reclosers, the Type NR switch is filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

Joslyn "ARRESTER-CUTOUT"

COMBINATION

providing **POSITIVE PROTECTION** from lightning
and a **FAST ACTION** fused cutout
in one **COMPACT** unit with
real **ECONOMY** in cost

JOSLYN 1902 1952 50th ANNIVERSARY

Complete Line Equipment

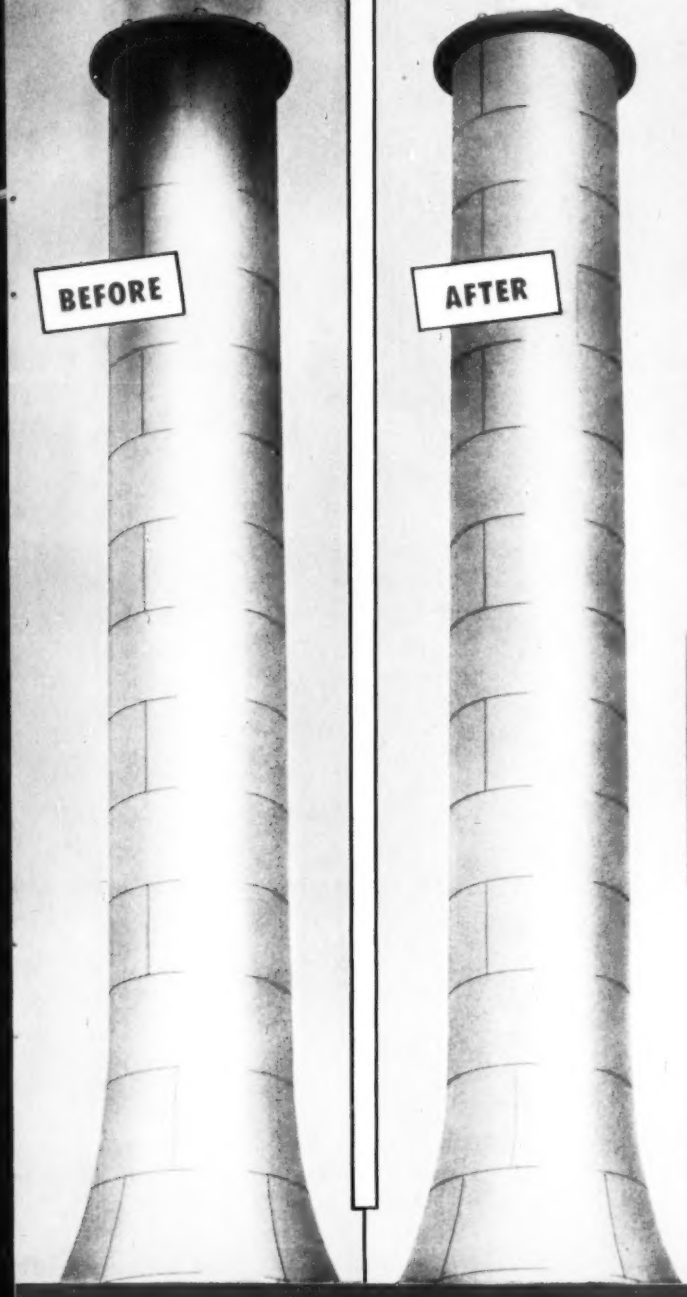
Unit Shown: 7.8 kv, 100 amp.
Available also in 15 kv, 100 amp rating.

Joslyn MFG. AND SUPPLY CO.

BRANCH OFFICES IN PRINCIPAL CITIES — 20 North Wacker Drive, Chicago 6, Ill.

The Joslyn Co. • The South East Joslyn Co. • Southern Joslyn Co. • Joslyn Southwest Co. • Joslyn Pacific Co.

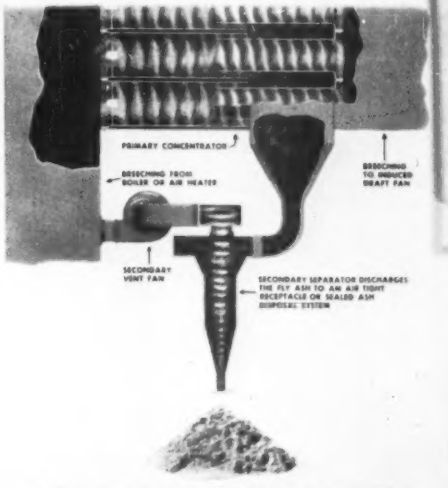
American Blower . . . a time-honored name in air handling



Installation of an American Blower Type ST Fly Ash Precipitator can make the difference shown here.

On a given application, as the load falls off and fly ash becomes harder to catch, the ST Precipitator automatically maintains a higher efficiency than any other collector of mechanical type.

Contact the American Blower or Canadian Sirocco Branch Office nearest you. They are conveniently located throughout the United States and Canada to provide complete information concerning the benefits of installing fly ash precipitators in your plant to meet your specific needs. Call on one today.


PRIMARY CONCENTRATOR
BREECHING FROM BOILER OR AIR HEATER
BREECHING TO INDUCED DRAFT FAN
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

Serving home and industry

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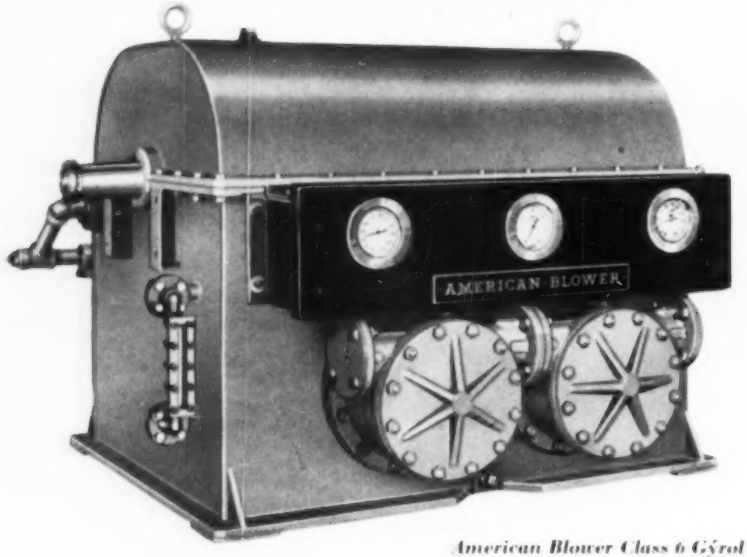
American Blower . . . a time-honored name in power plant equipment



American Blower Class 6 Gyrol Fluid Drive

Memo to Power Plant Men —

You can enjoy important power savings, flexible stepless control, reduced maintenance, and get lower pressures at reduced flows for your boiler-feed-pump operation. Install an American Blower Adjustable Speed Gyrol Fluid Drive with a constant speed driving motor.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
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Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

FLOOD CONTROL! Two-way radio communication plays an important part in the fight to save lives and protect towns from raging flood waters. Major breaks can be prevented by instantaneous dispatching of repair crews via G-E 2-way radio.

LARGE AREA CONTROL! San Diego Gas & Electric Co. central office communication system is tied in to the mobile net. In 5 years peak load jumped 70%! G-E 2-way radio helps them serve nearly 200,000 customers.

DEPENDABLE COMMUNICATION IN ALL WEATHER! Snow and high winds made line communication impractical for the Black Hills Power and Light Co. of South Dakota. CAS* engineers solved the problem—dependable G-E 2-way radio carries voice messages instantly throughout the system.

TOUGH MAINTENANCE AND REPAIR JOB! Emergency use of radio is illustrated where wire is repaired after severe sleet storm in eastern Pennsylvania. G-E radio in truck, right, was only communication between workmen and dispatching office when instructions were needed quickly.

G-E 2-WAY RADIO IS THE ANSWER

● For complete advice on your communications problem, contact the CAS* man in the G-E office nearest you, or write: *General Electric Company, Section 19122-29, Electronics Park, Syracuse, New York.*

**Communications Advisory Service*

GENERAL ELECTRIC

MAGNET WIRE

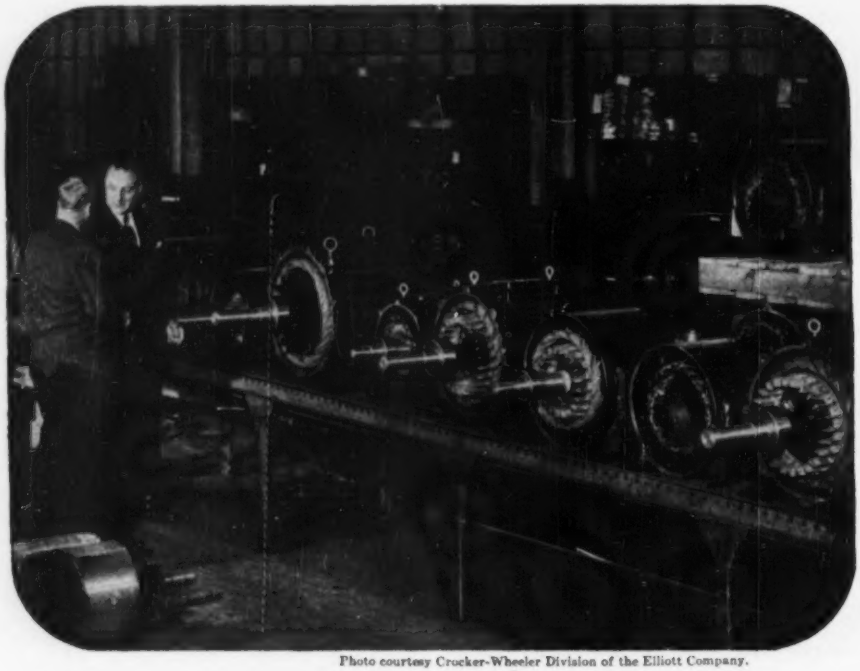

Photo courtesy Crocker-Wheeler Division of the Elliott Company.

Roevar . . . you can't buy a finer magnet wire

CONTINUAL IMPROVEMENT is a distinguishing feature of Roebling's electrical wire and cable line. And to make Roebling Roevar Magnet Wire today's A-1 specification for high speed winding, we use the toughest insulation we know of.

This Roevar insulation is *many times* more abrasion-resistant than conventional enamels. It is highly resilient . . . bends to a remarkable degree without cracking or coming loose from the conductor. On top of that, it has extra resistance to the solvents that are used in coil-treating varnishes and to all usual baking temperatures.

Roevar Magnet Wire comes in sizes No. 14 to 40 A.W.G. . . . and its small diameter is an important factor in many applications. You can depend on us for the best deliveries possible under today's conditions. John A. Roebling's Sons Company, Trenton 2, N. J.

ROEBLING

ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. & 5 PITTSBURGH ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 15225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 815 FISHER BLDG. • HOUSTON, 5216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. & 120 S. HEWITT ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1801 CLARK BLDG. • ROCHESTER, 1 FLINT ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • ST. LOUIS, 2001 DELMAR BLVD. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

KEARNEY FUSE LINKS

DESIGNED FOR ACCURATE SYSTEM-WIDE COORDINATION

FUSE coordination today is much more than a convenience. It is a dollar-and-cents necessity. Increased loads . . . increased operating costs demand service continuity. Kearney Fuse Links are the industry's standard. They lead the field in sales because of proved performance, better coordination with reclosers, sectionalizers and other fuses. Extreme time-current accuracy is made possible by field-tested design plus dependable low temperature characteristics of the pure tin elements.

Look at your records. If you have been dropping loads, tripping station breakers, damaging equipment . . . losing revenue needlessly because of faulty fuse coordination, it is time to switch to Kearney. Write today for complete curves and data on all the Kearney Fuse Links. They are the answer to better operation tomorrow.

JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE., ST. LOUIS 10, MO.
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JAMES R. KEARNEY
The Mark of Quality Products

STANDARD PACKAGE
25 FUSE LINKS

FOR THE RIGHT LINK
AT THE RIGHT PLACE
AT THE RIGHT TIME
Install
KEARNEY
FUSE LINK
DISPENSER

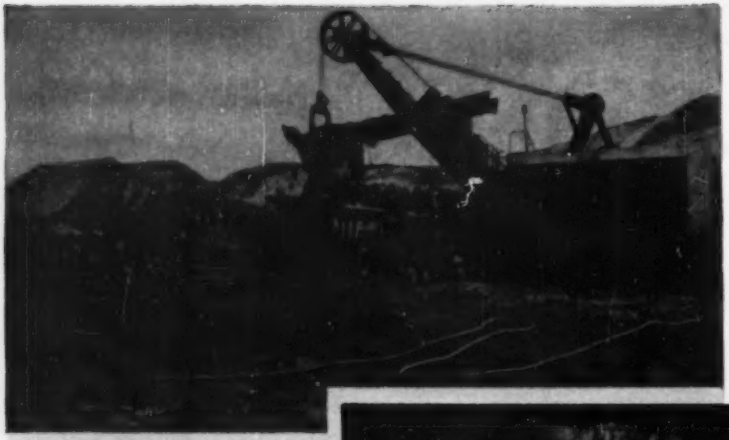
10 AMP. 10 AMP. 10 A

209

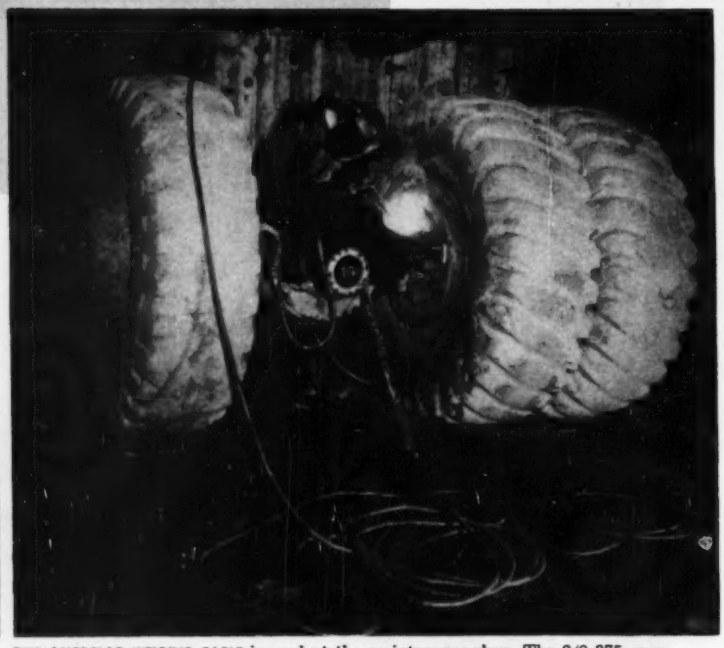
Kearney Products

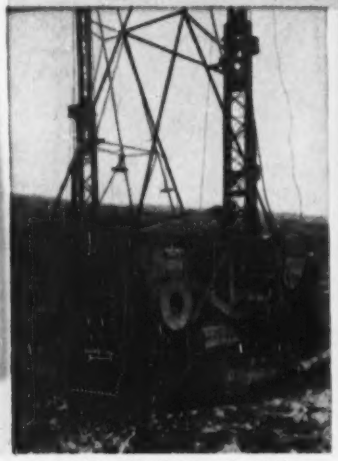
FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

the rocks



NOTICE THE FLEXIBILITY of this No. 4, 5,000 volt AMERCLAD Cable. It contains a special crepe paper slipper applied over the conductors to permit easy bending.





HERE ARE the drills that punch out thousands of feet of holes every day. Notice how easily the cable can be coiled around the take-up reels.

THIS AMERCLAD WELDING CABLE is used at the maintenance shop. The 2/0 375 amp. cable is made up of 3,325 individual wires to provide super-flexible operation and ease the strain on the operator's wrists.

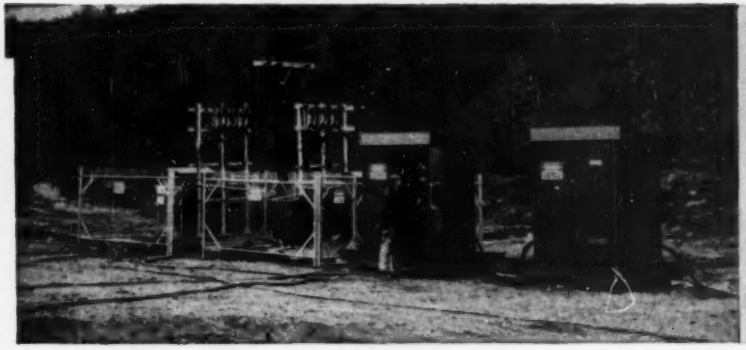
A STANDARD Cable for every

- ▶ **paper & varnished cambric cables**
- ▶ **asbestos cords and cables**
- ▶ **aerial, underground & submarine cables**
- ▶ **shovel & dredge cables**

AMERICAN STEEL & WIRE DIVISION ★ USS ★ UNITED STATES STEEL
AMERICAN ELECTRICAL WIRE AND CABLE

U·S·S AMERICAN ELECTRICAL

get so hot you can't touch them
but Amerclad
withstands the heat



THESE ARE TYPICAL switch houses and portable substation at the mine. Average length of cable used is 2,500 feet. The company has been using the original AMERCLAD for 7 years.

ONE of the nation's leading coal producers is stripping an area that is honeycombed with old mines. Many of these mines are burning, some for as long as 20 years. The rocks get so hot that you cannot walk on them or touch them, but miles of U·S·S AMERCLAD lie on the blistering rock without damage. Naturally, the mine operators try to protect the cable, but a lot of it has to lie on the ground.

This mine uses about 11 miles of AMERCLAD heavy-duty portable cable for power shovels and drills. The cable is unavoidably pulled over razor-sharp rock, soaked in acid water and exposed to the direct rays of the sun. In addition, thousands of yards of dirt and rock are blasted every day, and a lot of it comes down hard on the cable.

Despite all this, the AMERCLAD Cable is turning in a fine record of service. *It has to*, because, as the Chief Engineer puts it, "Every time a shovel is idle, there is a loss of production that is never made up."

If you have an extremely abusive use for portable cable or cord, let us show you just what AMERCLAD can do. There is a standard AMERCLAD Cable or Cord for every special application—whether it's a hand-operated drill, or a river dredge. Just send the coupon.

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL COMPANY
GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SPECIAL Job!

- ▶ **oilproof portable cords**
- ▶ **plastic machine tool & building wire**
- ▶ **special purpose cords & cables**

WIRE & CABLE

SEND THE COUPON

American Steel & Wire Division
Room EE-1??, Rockefeller Building, Cleveland 13, Ohio
☐ Please give me more information on U·S·S AMERCLAD.
☐ Have representative call.

Name .....
Title .....
Company .....
Address .....
City ..... State .....

UNITED STATES STEEL

LET THE WEATHER TAKE OVER

YOUR INSULATOR-SCRUBBING CHORE

Lapp High-Strength (23,000 lb.) Fog-Type Suspension Unit

Lapp Standard (15,000 lb.) Fog-Type Suspension Unit

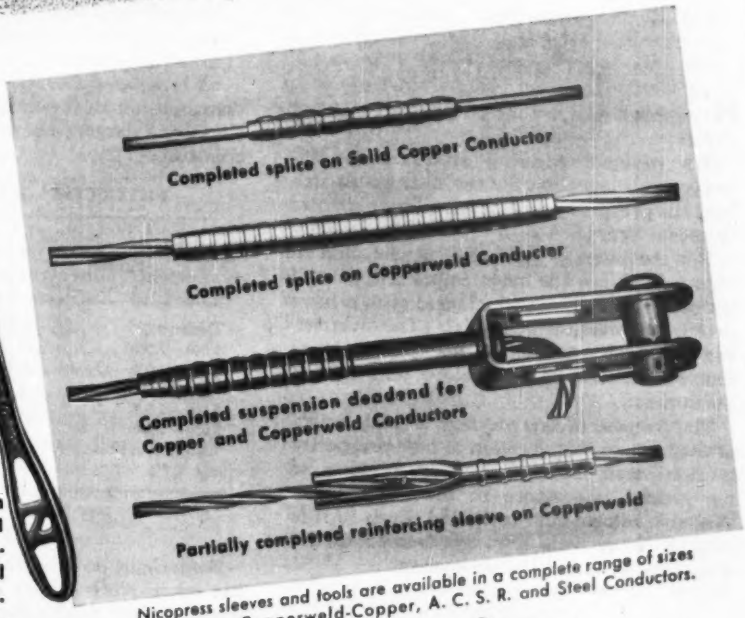
Industrial progress is wonderful! It builds load, increases national wealth, and is our hope for Peace by making us a formidable potential military power. But more and more industrial processes bring more and more contamination to transmission insulators. And some of it is sure hard to get off! Lapp Fog-Type design has a long record of successful service in areas of most severe salt fog, dust and industrial fumes. 56% more leakage distance than standard units gives it a big initial advantage. More uniform leakage path avoids arc-starting hot spots. And petticoat shape and spacing are such that wind and rain flush off accumulated dirt.

Lapp

LAPP INSULATOR COMPANY, INC., LEROY, NEW YORK

"JOB PROVEN" THE WORLD OVER Nicopress

Illustration of No. 51 type Nicopress tool with P. & J. Grooves.


Completed splice on Solid Copper Conductor
Completed splice on Copperweld Conductor
Completed suspension deadend for Copper and Copperweld Conductors
Partially completed reinforcing sleeve on Copperweld

Nicopress sleeves and tools are available in a complete range of sizes for Copper, Copperweld-Copper, A. C. S. R. and Steel Conductors.

Nicopress

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PROSPERITY in the USA: Who Has It?

How prosperous *are* the people of the United States?

The previous editorial in this series answered this question for the average American. His prosperity has increased only slightly in recent years.

But the average tells only a part, and in many ways not the most important part of the story. Which individuals and groups have prospered more, which less? (The average, the result of a statistical calculation rather than a creation of flesh and blood, tells nothing about that.)

The purpose of this message is solely to get at the facts on this question of how prosperity is distributed. This is not easy. In spite of the crucial importance of the subject, the available information is limited. Even so it is possible to provide a rough answer to the question, "Who has the prosperity?"

We Have Had a Revolution

The distribution of income in the United States has changed so greatly in the past twenty years that Arthur F. Burns, Research Director of the National Bureau of Economic Research, world renowned for its impartiality and technical competence, calls it "one of the great social revolutions of history." A part of this revolution is portrayed by the following table which shows that individual incomes are both much larger and much more evenly distributed than they were twenty years ago. Clearly, a large new middle-class has been created.

DISTRIBUTION OF REAL INCOME

Dollars of Income*	Per Cent of Families in Each Income Group	
	1929	*1951*
Under 1,000	17%	13%
1,000 – 2,000	24	15
2,000 – 3,000	24	18
3,000 – 4,000	14	18
4,000 – 5,000	6	15
5,000 – 7,500	9	14
7,500 and over	6	7
	100%	100%

*Adjusted for price changes to give the dollar its 1951 purchasing power.

Some light on why this income revolution has taken place can be found by tracing incomes to their source. Since 1929, for instance, employees have clearly made the biggest gains in total income. This can be seen in the next table. People who own their own businesses have done second best. Farmers, who are often thought to be doing handsomely indeed, have been outstripped in the income race by employees and businessmen. People whose incomes depend upon pensions, insurance policies, and other relatively fixed returns such as rent, interest and dividends have lagged far behind.

HOW REAL INCOME HAS CHANGED*

Types of Income	Percentage Change 1929 to 1951
Wages & salaries of employees.	+123%
Income of professional men & unincorporated business	+108
Farm operators' income	+56
Rental income	+1
Dividends	+2
Interest	−35

*In this and the previous table account is taken of changes in the cost of living. But adjustment for the changing tax load was not possible, as it is in the computations which follow.

The Biggest Gains

Employees have made the biggest gains in income, but the term "employees" covers a wide assortment of people—from the presidents of the biggest corporations to factory sweepers. How have different groups of employees prospered? Some indication is provided by results of a survey of salaries in 41 corporations made by Arch Patton of McKinsey and Company and recently summarized in the *Harvard Business Review*. This survey showed that between 1939 and 1950, after adjustment both for higher living costs and for higher taxes, factory and office employees made modest gains in income while management personnel suffered losses ranging from 40% to 60%.

While factory and office workers generally have made greater income gains than others, their gains have varied greatly from industry to industry. During the past five years, for example, steel workers' take-home pay (adjusted for both taxes and price changes) has increased by 22%, that of textile workers 9%, employees of general merchandise stores 4%, and that of laundry workers not at all.

What About Organization?

How have organized workers fared compared to unorganized workers? There is no round-up of facts that makes possible a direct comparison between the two. Such evidence as there is shows it is indeed an open question whether union members have done any better than others. Steel workers, for instance, who are strongly unionized are among the highly paid manufacturing workers. Farm workers are generally not unionized, and they work in one of the most competitive industries in America.

But farm workers have made income gains which far surpass those of steel workers. Real wages of farm workers increased 2½ times more than those in the steel industry between 1939 and 1952. This fact may prove nothing more than that, in a period of inflation and manpower shortage, the less skilled workers whose incomes are ordinarily low make the biggest percentage gain in income. Further support for this conclusion is found in the construction industry where real wages of unskilled labor increased 37% between 1939 and 1952, while those of skilled labor increased only 4%.

Why Most Incomes Are Higher

Prosperity, who has it? We may conclude that workers have been getting much more of it lately than managers or property owners, that unskilled wage and salary earners have made the largest gains, and that income generally is much more evenly distributed.

Where has the money come from to raise low bracket incomes? It has come partly from an increase in the total national income, but partly also from cutting down the share received by people in the highest income brackets. While the top 5% received 33.5% of the income after taxes in 1929, their share of income has now been cut about in half. For every $11 of increase in income to the lower 95% of income receivers, about $7 has come from increased production, and about $4 by taking that amount from the top 5%.

Top bracket incomes have now been cut so deeply that the possibilities of increasing the income of the rest of the people by "soaking the rich" have largely disappeared. Indeed, if all of the income after taxes of everyone earning over $25,000 in 1951 was taken away and redistributed among the remaining Americans, each person would receive only about $65.

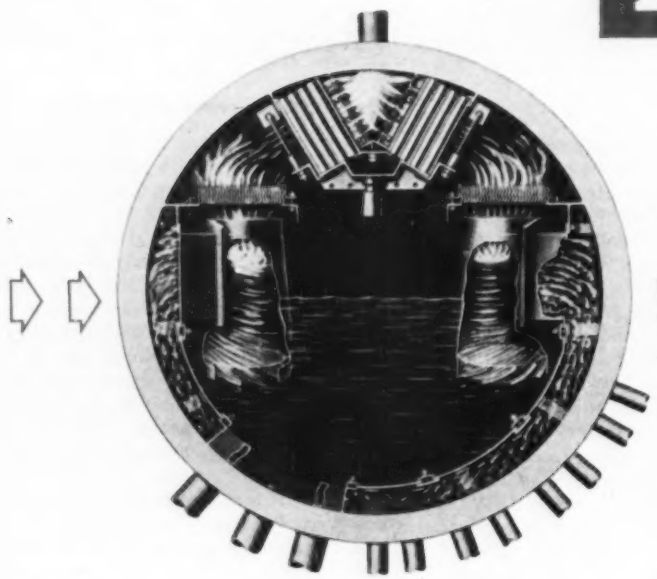
The significance of this revolution in income distribution is clear. It is that there is only one way by which the great mass of us Americans can continue to increase our individual prosperity. This is by earning the increase through more and more efficient production. In plotting the economic course of the U. S. A. this fact is of decisive consequence.

McGraw-Hill Publishing Company, Inc.

14 YEARS

of operating experience with STEAM

OVER 2000 PSI



An important element in successful high-pressure operation is the B&W Cyclone Steam Separator, developed by B&W Research. This simple, highly efficient device is typical of the manner in which B&W's progressive research pushes the science of steam generation to ever higher levels of economy.

For those seeking the high steam-cycle efficiencies obtainable with steam pressures over 2000 psi, B&W offers unparalleled design and operating experience . . . drawing upon a background extending over the last 14 years with units to serve over 10,000,000 kilowatts of generating capacity.

The outstanding performance records of the 14 B&W installations already operating in this range have given strong impetus to the present trend toward use of pressures over 2000 psi . . . have resulted in orders for more than 60 additional B&W units with design pressures up to 2700 psi.

B&W's many years of experience in designing and building boilers for economical, high-pressure steam generation, as exemplified in the list on the opposite page, are at your service.

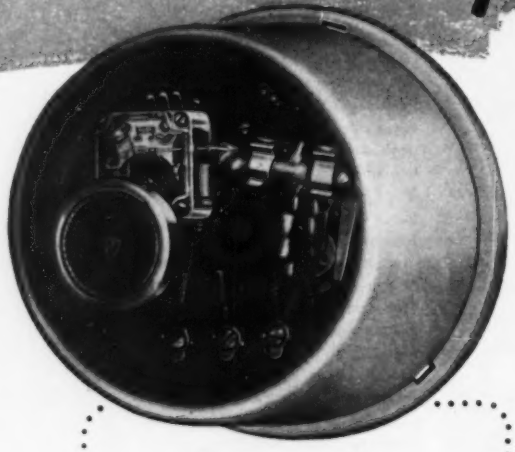
G-5851

B&W BOILERS WITH DESIGN PRESSURES OVER 2000 PSI

Owner	Boiler Design Pressure
Diamond Alkali Co.	2200
Indiana & Michigan Electric Co.	2650
Appalachian Electric Power Co.	2300
Indiana & Michigan Electric Co.	2300
The Ohio Power Co.	2300
Commonwealth Edison Co.	2125
Indiana & Michigan Electric Co.	2300
Appalachian Electric Power Co.	2300
Commonwealth Edison Co.	2125
The Ohio Power Co.	2300
Public Service Co. of No. Illinois	2050
Indiana & Michigan Electric Co.	2300
Consolidated Edison Co. of N. Y.	2050
Philadelphia Electric Co.	2075
Consolidated Edison Co. of N. Y.	2050
Pennsylvania Electric Co.	2080
Philadelphia Electric Co.	2075
Detroit Edison Co.	2050
Appalachian Electric Power Co.	2400
Commonwealth Edison Co.	2125
Tennessee Valley Authority	2050
Commonwealth Edison Co.	2125
Detroit Edison Co.	2050
Jersey Central Power & Light Co.	2225
Georgia Power Co.	2100
Southern California Edison Co.	2050
Narragansett Electric Lighting Co.	2350
Public Service Co. of No. Illinois	2125
Tennessee Valley Authority	2050
Ohio Edison Co.	2300
Pacific Gas & Electric	2050
Public Service Elec. & Gas	2700
Indiana & Michigan Electric Co.	2400
Tennessee Valley Authority	2050
Tennessee Valley Authority	2050
Tennessee Valley Authority	2050
The Ohio Power Co.	2400
The Ohio Power Co.	2400
Ohio Edison Co.	2500
Consolidated Gas Electric Light & Power Co.	2075
Ohio Valley Electric Corp.	2400

TOTAL GENERATING CAPACITY SERVED: OVER 10,000,000 KILOWATTS

On the line only one minute per day!



WESTON Illumination Control

(automatic, plug-in type)

Draws a few milliamperes *only* during operating cycle—about 1 minute per day.

Uses no vacuum tubes, phototubes or resistors—has only the few simple components illustrated.

Servicing is quick and simple—no radio techniques involved.

One unit controls 3,000 or 6,000 watts, at 120 volts a-c.

Mounted in standard weather-proof watthour meter case. For full details, consult your local WESTON representative, or write . . . WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, N. J.

Components:

Sealed barrier layer *Photronic Cell

***Sensitrol Relay**

Mercury Switch

Synchronous motor with cam and limit switch

*TM

WESTON *Instruments*

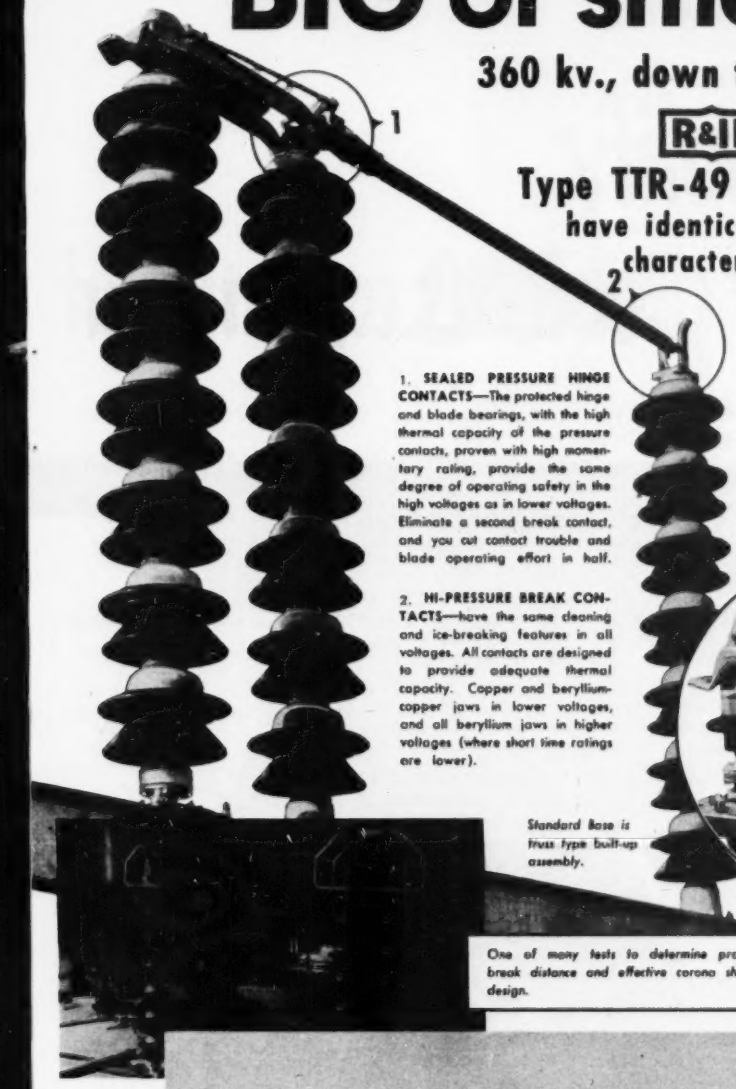
1286

BIG or small...

360 kv., down to 7.5 kv.,

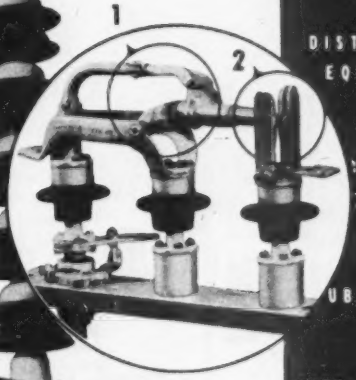
R&IE

Type TTR-49 SWITCHES have identical design characteristics



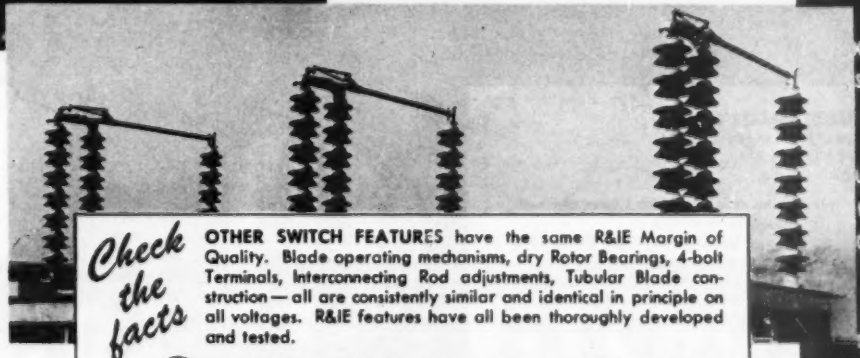
1. **SEALED PRESSURE HINGE CONTACTS**—The protected hinge and blade bearings, with the high thermal capacity of the pressure contacts, proven with high momentary rating, provide the same degree of operating safety in the high voltages as in lower voltages. Eliminate a second break contact, and you cut contact trouble and blade operating effort in half.

2. **HI-PRESSURE BREAK CONTACTS**—have the same cleaning and ice-breaking features in all voltages. All contacts are designed to provide adequate thermal capacity. Copper and beryllium-copper jaws in lower voltages, and all beryllium jaws in higher voltages (where short time ratings are lower).



Standard Base is truss type built-up assembly.

One of many tests to determine proper break distance and effective corona shield design.



Check the facts

OTHER SWITCH FEATURES have the same R&IE Margin of Quality. Blade operating mechanisms, dry Rotor Bearings, 4-bolt Terminals, Interconnecting Rod adjustments, Tubular Blade construction — all are consistently similar and identical in principle on all voltages. R&IE features have all been thoroughly developed and tested.

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO. GREENSBURG, PA.

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES (INDOOR AND OUTDOOR)

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DISTRIBUTION EQUIPMENT

...N OPERATING ...CHANISMS

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OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

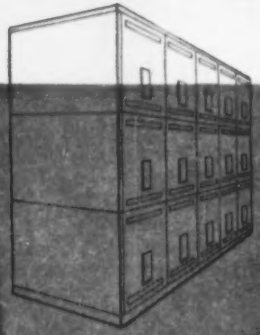
...K INTERLOCK ...SYSTEMS

...UTOMATIC ...WITCHING ...QUIPMENT

...TAL CUBICLES

TESTING DEVICES

To simplify switchgear problems...plan your



BEFORE YOU SPECIFY—SEND FOR YOUR FREE COPIES OF THIS INFORMATIVE I-T-E LITERATURE

I-T-E Selection and Application Data is specially prepared by I-T-E application engineers to help you through the important steps in planning your switchgear system.

CATALOG SECTION 1003—Comprehensive, illustrated 50-page catalog contains complete data on selection and application of I-T-E low-voltage air circuit breakers and individually enclosed circuit breakers (Urelites).

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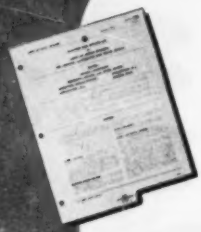

CATALOG SECTION 6004—gives full information on I-T-E Multumite metal-enclosed, low-voltage switchgear. Completely describes I-T-E drawout construction and cubicle design. Contains useful specifications, dimensions, and suggestions for planning your metal enclosures.

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I-T-E CIRCUIT BREAKER CO.
Switchgear Division, Dept. EW
19th and Hamilton Sts.
Philadelphia 30, Pa.

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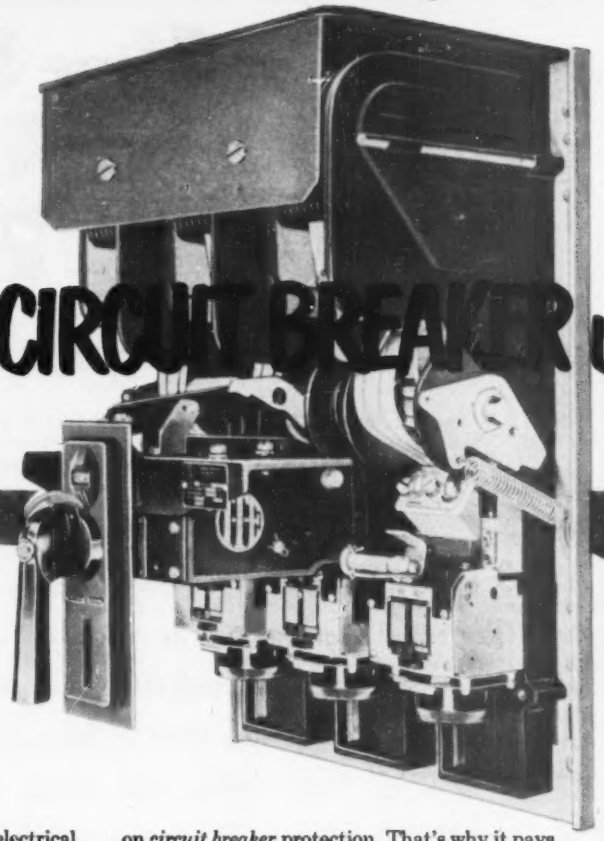


I-T-E CAN SUPPLY INDOOR AND OUTDOOR EQUIPMENT IN RATINGS:

15,000 to 100,000 amperes interrupting
600 volts a-c, 250 volts d-c
to 6,000 amperes continuous, a-c or d-c
to 10,000 amperes continuous, d-c only

Expansion or modernization of your electrical distribution system calls for detailed analysis. Before you can properly select your system and equipment, you must consider such important factors as load, power supply, circuits, *protection*, and *reliability*.

This means getting down to fundamentals. And, fundamentally, system reliability depends on *circuit breaker* protection. That's why it pays to think of your switchgear requirements *first of all* as circuit breaker applications.

Follow these three simple steps when planning your switchgear layout. You can then be sure that the circuit breakers you buy will provide the protection you need:

- **KNOW YOUR APPLICATIONS**—their load characteristics, protection requirements, need for continuity of service;
- **KNOW THE CIRCUIT BREAKER** features and functions that will satisfy all application requirements;
- **KNOW THE MANUFACTURER**—his ability to help you solve your problems and provide the best breakers for the job.

I-T-E experience and specialists are at your service. Your local I-T-E application engineer will gladly work with you on any switchgear problems. Get to know him. Give him a call—*today*.

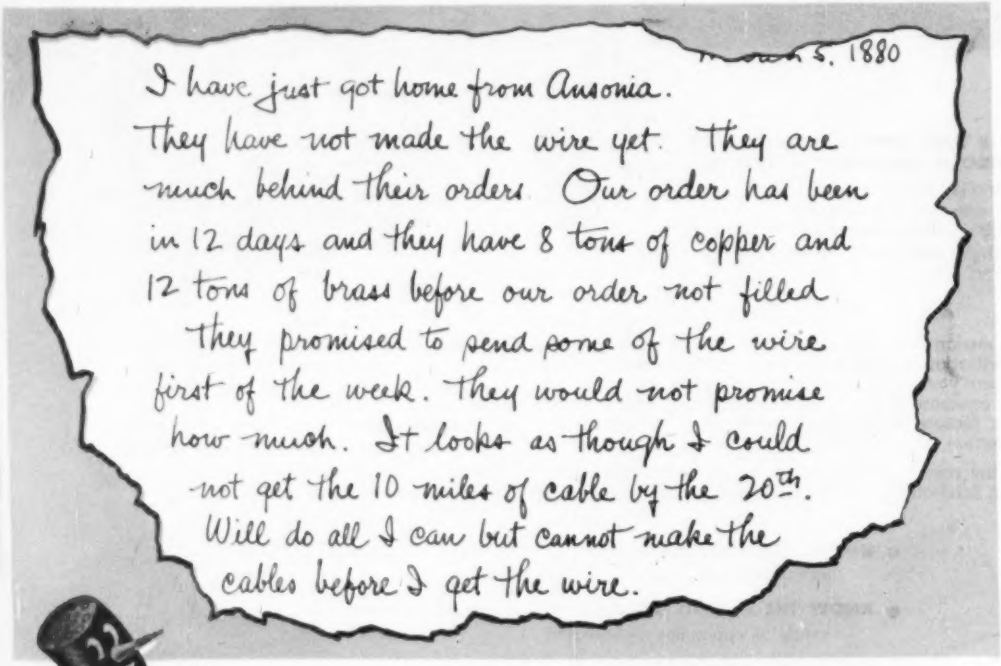
VOLTAGE SWITCHGEAR

BREAKER COMPANY • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., N. Y. 17, N. Y.

"I cannot make the cables before I get the wire"

Sounds like an old refrain, doesn't it? It is at least as old as 1880, when A. G. DeWolfe wrote from Seymour, Connecticut (where Kerite Cable still is manufactured) to Austin G. Day in New York:


5. 1880
I have just got home from Ansonia.
They have not made the wire yet. They are
much behind their orders. Our order has been
in 12 days and they have 8 tons of copper and
12 tons of brass before our order not filled.
They promised to send some of the wire
first of the week. They would not promise
how much. It looks as though I could
not get the 10 miles of cable by the 20th.
Will do all I can but cannot make the
cables before I get the wire.

There isn't any modern moral to this story, except perhaps that, however impatient we Americans become, we always seem to outlast our crises and do a bigger and better job no matter what obstacles are put in our way.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.

THE VALUE AND SERVICE LIFE OF A PRODUCT CAN BE NO GREATER THAN THE INTEGRITY AND CRAFTSMANSHIP OF ITS MAKER.

Trees Are Beautiful But:—

Reliable service is essential for the modern home. Dependent upon electricity for lighting, cooking, and refrigeration, the owner is greatly inconvenienced by service interruptions. His heating system shuts off, his clocks stop, and he has neither radio nor television to ease his concern. His situation is critical in many cases. Solution of this problem requires much more interest on the part of utility managements.

Trees come first in causing service interruptions. If distribution engineers can't avoid them or remove them, they use higher poles and trim the upper branches. But trimmed trees grow faster. When trimming fails because of rapid growth or public opposition, utilities string tree wire.

While the line personnel have toiled to minimize tree trouble, relay engineers have tried to clear the circuit momentarily before serious damage occurs. The heavy-conductor portions of distribution circuits usually are saved and quickly restored to service in this manner. But one company finds nearly 90% of its trouble on small primaries which continue to burn down.

Several utilities have sought out basic facts about conductor failures. One found that limbs lying on 4-kv wires do not cause trouble until the limb ignites and initiates a power arc.

Another concluded that covering on conductors contributes to their failure. It resists initiation of an arc. But if an arc occurs, they found that the arc is confined, thereby burning away the conductors. Extremely rapid clearing is required to save the conductors. Line fuses must coordinate with heavy fusing of the customer's service switch and the transformer on the pole. Seldom can they also protect the wire.

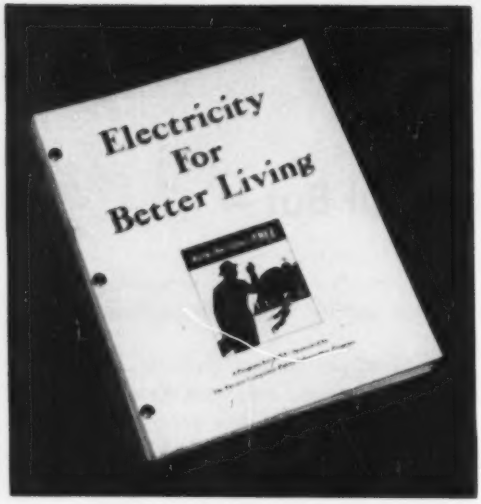
Some believe that bare conductors are less subject to arc damage. They think the arc, propelled by natural forces, is less prone to hang and destroy the conductor. Thus larger fuses, or sometimes the breaker itself, satisfy protection needs.

Fast initial clearing of the branch circuit—similar to that provided by a small fuse—followed by immediate automatic restoration is favored by many engineers. They believe this converts incipient burndowns into momentary interruptions unnoticed by the customers. The oil circuit recloser reflects this philosophy.

Other engineers seek similar benefits in a contactor actuated by excessive current to short circuit the line. Such a device is said to quench the destructive arc, bypassing its current harmlessly until the circuit breaker opens.

Both methods should help to cut interruption time. But there are many locations where neither is applicable because the load current is greater than the permissible fault current.

Electric service today demands judicious consideration of all methods. Engineers must investigate each circuit, determine its troubles, and correct them. They must evaluate each method and develop better techniques. Finally, they must work with manufacturers and other utilities. The problem can be solved. Distribution wires can be protected. Then—and only then—will all modern homes have the service they need.



Electricity For Better Living

It is impossible for an American to think of living, much less of living better, without electricity. There are more homes wired for electricity in the United States than in any nation in the world. We have more electrical appliances; we use more electricity. But why we enjoy these advantages is still not understood by millions of Americans. To answer this question for them, the electric companies will talk about Electricity for Better Living in 1953.

The electric companies know this story: How they pioneered in bringing electricity to the homes, how they promoted the use of home electrical appliances, how they constantly reduced the price of electricity per kilowatt hour, how they expanded their facilities so that all Americans can have reliable electric service. The companies have told this story so often that all should know it. But a large segment of the public has turned a deaf ear because it could not see how it was affected. Now is the chance for the industry to tell this story in terms of the home.

For one week beginning next May 25 the entire industry is invited to join the companies participating in the Electric Companies Public Information Program in explaining to all Americans their stake in the free enterprise system. And how easy this should be.

Today even the poorest Americans have incomes that are unbelievable in foreign countries. They can go into stores with shelves and floors crammed with the most efficient electrical appliances ever made. They can buy these "on time." And they can use them in their homes because in America "electricity is cheap," and there is all the electricity available that anyone wants to use. The nobility and the wealthy of foreign lands seldom can live so well as the ordinary worker in these United States.

And this is the story that PIP invites all segments of the industry to join it in telling. PIP invites the utilities, the contractors, the manufacturers, the wholesalers, and the retailers. And for each segment there can be a selfish motive. If the public is really sold on "Electricity for Better Living," there is a golden future for the people in happiness and for all segments of the industry in sales and profits.

Why We Celebrate Thanksgiving

The Pilgrims were the first to observe a day of Thanksgiving, in 1623 . . . but do you know why they celebrated?

They celebrated because they had discarded communism!

When they landed at Plymouth in 1620, they tried out a beautiful idealistic dream . . . Fall crops raised for their food were to belong to the colony, for equal division, and not to the individuals who worked in the fields.

It didn't work . . . For three years they nearly starved because there just wasn't enough work put into raising the crops. The "perfect way of life" actually operated to kill initiative and self-respect. So they gave it up, and tried individualism—free enterprise! Said their Governor, Bradford, in his diary: "They should set corn every man for his own particular, and in that regard, trust to themselves . . . This had very good success, for it made all hands very industrious . . . much more corn was planted . . . and gave for better content."

The Pilgrim History records that not long after they gave up communism for individualism, there were plenty of workers in the fields, and soon there was more than enough food for everyone.

In gratitude they set aside a "Solemn Day" for proclaiming "glory, honor, and praise with all thankfulness to our great Lord." That early custom inspired Abraham Lincoln to issue the first Thanksgiving Day proclamation, in 1863.

• • •

The preceding paragraphs are taken word for word from a recent advertisement of the Public Service Co of New Hampshire. The ad's message to all Americans is that the road to communism is the road back to where we were 300 years ago. And it is a message that every company which believes in free enterprise should reprint (with permission) next Thanksgiving season.

A New Authority on Plant Depreciation

Estimating plant depreciation is one of the most difficult problems faced by the industry. To the wide field of literature on this subject has been added another booklet, "Methods of Estimating Utility Plant Life." This is the work of the engineering subcommittee of Edison Electric Institute's Depreciation Accounting Committee (For a review of this booklet see page 73).

The subcommittee, headed by Paul H. Jeynes, Public Service Electric & Gas Co, prepared the 63-page booklet to reflect both the engineering and accounting viewpoints of depreciation. It does not recommend any particular method of accounting for the fact of depreciation. But it does go minutely into the complexities of the subject. Graphs, tables, and examples are used to aid the reader.

To the more common methods of life analysis the booklet contributes a new technique, simulated plant-record methods of life analysis. This is fully discussed.

The booklet will never be popular reading. But the specialists working in the field of utility plant depreciation should welcome it as a new authority. To get a copy write Edison Electric Institute, 420 Lexington Avenue, New York 17, N. Y. Ask for Publication No. 51-23. The price to non-members is $3.75 in this country, $3.90 abroad.

THE ELECTRICAL WEEK

The Issue's News Highlights—Dr Paul Raver, head of Bonneville Power Administration, recommends to Bonneville Council that functions of the agency be turned over to local control. Commented Interior Secretary-designate McKay: "I am in favor of any good plan to get the government out of the power business."

AEC Chairman Gordon Dean expresses a "personal opinion" that more reactor information should be declassified to give private industry an opportunity to develop nuclear power for commercial purposes. He urges changes in the Atomic Energy Act of 1946.

Off the Washington Wire—Possibility of a 22-state power transmission grid for western states is discussed in a report to be issued this week by Reclamation Bureau. Program considered calls for lines of 330 kv and larger and would necessarily extend 10 to 20 years in future.

Also this week USBR will release its six-year program of reclamation projects—the last such program which will be put together by a Democratic Administration for four years at least.

New Economy Note: Future visitors to Grand Coulee and Hungry Horse Dams will have to pay 25¢ each for guided tours of these government projects.

A concensus of Washington mobilizers is that utilities and electrical equipment manufacturers will get most of the controlled materials they will need during first and second quarters of 1953. By end of second quarter some mobilizers say, supply of basic metals will nearly balance the controlled demand.

FPC consolidates proceedings on conflicting applications of New York State Power Authority and Public Power & Water Corp, Trenton, N. J., both of which are seeking an FPC license for developing St. Lawrence hydro project. Hearings will resume Feb. 2.

NSRB recommends to President Truman the amending of the Atomic Energy Act whereby "private interests could operate commercially to benefit from their atomic power research, development, and production." It also recommends a speed-up of new multiple-purpose reservoir projects to develop additional power supplies. It urges Interior Department to "draw up the broad outlines of a coal research and development program."

From New England—Wilder Lake, extending 45 miles north from a recently developed 33,000-kw hydro project of New England Electric System in Connecticut Valley near White River Junction, Vt., has been given the green light for recreational uses. Rufus Nelson, vice president, New England Power, tells upper valley residents company claims only the right of the free flow of water.

Albert A. Cree, Central Vermont Public Service president, tells Power Engineers Association of New England the area's moderately higher rates due to fuel freight charges are insufficient reasons for industry migration to other regions. If atomic power research developments succeed in years ahead economically, present regional rate differentials seem destined to become narrowed to insignificance, he says.

From East North Central—Bellaire, Mich., citizens vote to sell municipal plant to Consumers Power for $107,500.

From the Far West—Signing of a memorandum order by Judge Charles G. Wright in Thurston County Superior Court at Olympia, Wash., results in transfer to State Supreme Court of City of Tacoma's legal fight for permission to construct $146-million hydro project.

Financial—About 98.1% of $16,484,300 of 3¼% conv. debs offered by Consolidated Gas EL&P of Baltimore to holders of its common were subscribed for. Balance 1.9% were purchased by Halsey, Stuart & Co . . . New York PSC plans to issue fast accelerated amortization order shortly . . . McLeod, Young, Weir & Co has sold $25-million Hydro-Electric Power Commission of Ontario 4¼% bonds due 1964-67 at par . . . Underwriting group headed by First Boston Corp will sell 600,000 common shares of Toledo Edison Co around Jan. 13.

Public Relations—Public Service of New Mexico joins the Electric Companies Public Information Program.

Norwalk, Conn., Zoning Commission orders Connecticut L&P to defer building of $20-million steam plant on Manresa Island for 30 days. This will allow the commission more time to hand down a decision from evidence presented at a public hearing on Dec. 11. Company feels residential zoning of area will not be affected. Opponents contend it will down-grade the area and coal dust would cover buildings in the section.

Annual payments of American industry into retirement funds now total $2.2 billion a year and constitute one of largest and fastest growing investment markets in U. S., Rawson Lloyd, vice president of Wellington Fund, estimates in his recently completed study of pensions and profit sharing plans.

Engineers of Bureau of Internal Revenue approve an increase in depreciable property base and in rate for computing depreciation allowable for federal tax purposes which, it is estimated, will result in an increase in net income for Toledo Edison Co of about $400,000 for 1952.

Sen Herman Welker of Idaho is in favor of the government turning TVA over to private ownership. Speaking on "Meet the Press" radio-tv program last week he said TVA should be sold to private companies. Or shares of stock in the vast electric system could be issued to people who now own government bonds as proposed earlier by Charles E. Wilson, former GE head (EW, Oct. 6, p 81).

Congratulations—Southern Colorado Power Co elevates David B. Hyer Jr, from executive vice president to president, succeeding J. B. French who will remain as a director and a member of the executive committee.

Raver Wants Region to Control BPA

- **Administration's head suggests formation of Interstate Power Commission to take over Columbia River development**

- **Interior Secretary-designate McKay comments he favors "any good plan to get government out of the power business"**

Formation of an Interstate Power Commission within Pacific Northwest states to take over functions of Bonneville Power Administration has been proposed by BPA Administrator Paul J. Raver. In effect, Raver says the federal government should get out of the power sales and distribution business and turn back to the region the development of Columbia River hydropower potential. Raver's outline was presented to Bonneville's Regional Advisory Council meeting Dec. 16 in Seattle and broke unexpectedly on the industry.

Following Raver's proposal, renewed attention is expected to be given two other recent plans for retiring the federal government from the power activities in the region.

Other Proposals . . . The first, outlined in September by F. Ford Northrop, assistant superintendent of the Eugene, Ore., Water and Electric Board, envisages an interstate agency along the lines Raver proposes but with three major differences. The second, proposed in bill form in April to Congressmen by Gerard MacNamara, Portland, Ore., builder, calls for a non-political group consisting of the present utilities to take ownership and operation of the BPA transmission system and buy energy from the government-built Columbia Basin dams.

Private utility officials' reaction to Raver's plan was guarded but indicated it was a step in the right direction, although perhaps not far enough.

The Bonneville boss proposes the new interstate agency have authority to issue revenue bonds for construction of dams, determine priority of storage and generating projects and make sales agreements with private and public distributors.

Policy commissioners for the regional group, which would have to have legislative blessing of Washington, Oregon, Idaho, and Montana and also require Congressional action, would be either appointed by the state governors or elected, probably by the legislatures, according to each state's wishes.

Local Responsibilities . . . The Corps of Engineers and Bureau of Reclamation, which built Coulee and Bonneville respectively, might be utilized as construction agencies, or they might not. Raver also urged a study into local assumption of the costs of flood control, navigation, and fish and wildlife phases which are now paid directly by Congressional appropriation as non-reimbursable costs not charged to power revenues of the big dams. Raver hinted these might be paid from energy sales.

In appraising probable power rates, Raver noted the new organization would likely result in a wholesale rate of $24 per kw year in contrast to the present $17.50, which has been criticized in Congress as uneconomic. BPA rates are expected to go up within a few years anyway, perhaps to $22.50, because of higher construction costs of new federal system projects.

Cost estimates, compiled by Bonneville Comptroller E. O. Ostrander, were based on construction of 34 projects, 15 of them major dams on the main stream of the Columbia and Snake Rivers or major upstream storage projects, the others smaller structures mainly in the Willamette Valley of Oregon and the Yakima Valley in Washington. Total cost would be $5,516,000,000 on completion at today's costs.

Ostrander's appraisals assume that revenue bonds would pay interest. Nothing was said about taxes and the assumption was that Congress and the states would be asked to make them tax exempt. An effort would be made, however, to have Congress take "junior promisory notes" for repayment later or allow credit on the $1,250,000,000 debt involved in the existing federal investment of seven major dams and transmission systems now built or in the process of construction.

Sympathetic . . . Gov Douglas McKay of Oregon, Interior Secretary-designate, said he had not yet studied Raver's proposal, but added "I'm in favor of any good plan to get the government out of the power business."

In Washington, D. C., Sen Guy Cordon of Oregon revealed he had a share in initiating the studies on which Raver's plan was based. While in Portland, the senator said, he had discussed with Raver ways of bringing about changes to affect a greater measure of local control of Columbia River development. He said he had asked Raver to "look into it from an operations standpoint."

Cordon, a member of the Senate Interior and Insular Affairs Committee, admitted he was in favor of basic changes indicated by Raver's talk, but did not agree with all aspects. Specifically, he balked at the BPA chief's suggestion that any interstate agency might assume the financial burden of flood control, navigation, and fish phases. "When Raver talks about non-reimbursable costs he's on his own," the senator said.

Langlie's Views . . . Washington's Gov Arthur Langlie was quick to endorse the general principle of state control of the river development and management. But Langlie made it clear he

'No-Cost' Power Ends for Kansas City P&L

Utilities have often been troubled by consumers out to get no-cost power by diverting electricity from power lines for their private use. Recently a utility turned the tables and tapped a customer's line for its own use—inadvertently, of course.

Kansas City Power & Light Co discovered to its embarrassment that about a year ago a foreman at one of its storage yards hooked up a small saw to a nearby pole on which a transformer was installed. The pole, it turned out, belonged to a customer and the connection had been made on the customer's side of the meter. When it learned of the error, the company quickly readjusted the customer's bill by the amount involved—about $5—and made a new connection on its own side of the meter.

believed some projects could not be financed except through the federal government. Langlie said any cooperative plan should be arranged so the federal government's investment would be protected until paid off and the future financing of large projects be a part of this agreement.

In commenting on the Raver plan, McKay was asked about the BPA administrator's tenure in the post he's held for 13 years. Said McKay "I told Dr Raver that I hadn't decided whether I would want him to stay with Bonneville. I told him that if I decided that I didn't intend to keep him, I would give him plenty of notice."

Under the proposal of F. Ford Northrop, an interstate agency called the Northwest Power Commission would be created. Major differences from Raver's proposal lie in methods of financing, degree of cooperation with federal agencies in flood control and navigation projects, and use of funds derived from energy sales.

Northrop's Plan . . . Under Northrop's plan, financing would be done by issuance of revenue bonds, by borrowing from banks, investment firms, insurance companies, federal and state agencies, through Congressional appropriations, or other means deemed advantageous by the commission. In connection with flood control and navigation projects, the commission would contract with federal agencies for division of costs and operation. For example, the federal agency would build the dam and powerhouse and regulate flow of water for flood control, navigation and fish travel; the commission would install generating equipment and operate machinery with available surplus water.

Northrop's proposal calls for building steam plants to augment hydro generation, an action not mentioned by Raver.

The second recent proposal, made by Gerard MacNamara, calls for a Northwest power marketing grid to buy power at federal dams and transmit it to member companies.

By June, 1994, the grid would repay with interest the total amount of the government's net investment allocated to power in Grand Coulee and Bonneville Dams and BPA's transmission system. The grid would pay operating, maintenance and replacement costs of power equipment at these dams and of the present BPA transmission system.

Utilities May Get Reactor Data

Dean expresses "personal opinion" it is time to consider declassifying information relating to atomic power production

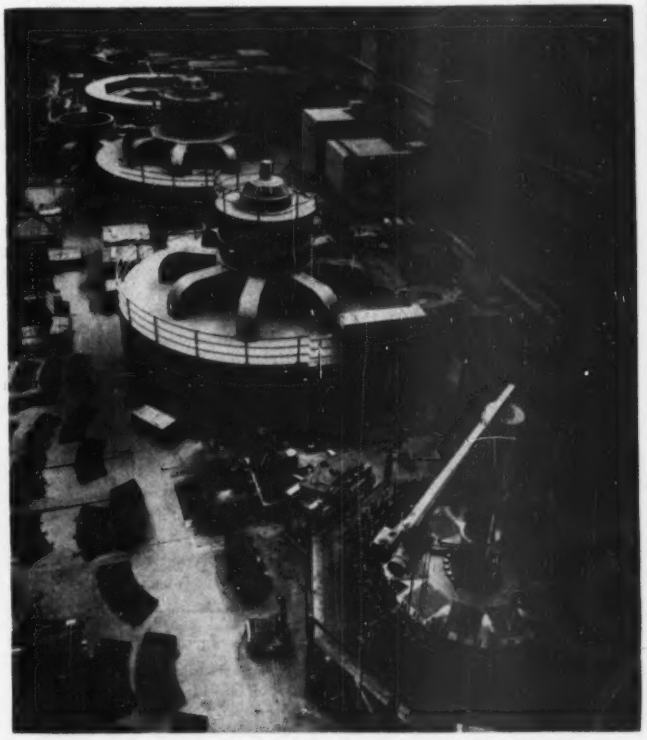
The electric power industry probably will get a lot more information on the technology of nuclear reactors in the near future.

Tip-off came from Atomic Energy Commission Chairman Gordon Dean in a recent speech at Brookhaven National Laboratory, Long Island. Dean expressed his "personal opinion" that the time had come to "give very serious consideration to the possibility of some rather major declassification actions in the field of nuclear reactors for the production of power."

Proposals Studied . . . At the same time AEC staffers were carrying on studies of proposals for releasing data on power reactors by some means that would involve a minimum of havoc to present security restrictions. Their problem was to give industry enough information on which to base satisfactory, technical and economic studies without endangering national security.

Several plans for accomplishing this end appear feasible to the commission's experts, it was learned.

Will Consult Ike . . . But certainly AEC will make available no additional information before it has the advice and consent of both President Eisenhower and Congress next year. The



Power for the Pacific Northwest

Two 71,250-kw generators already are operating at Hungry Horse Dam and are helping to alleviate the serious power shortage in the Pacific Northwest. A third unit of similar size is being assembled (foreground) and will go on the line in August 1953. The last unit will go into operation in November 1953.

Joint Congressional Committee on Atomic Energy, which already has discussed atomic power development with industry and government representatives, will hold hearings on the subject early next year (EW, Dec. 22, p 7). Indications are now that members of AEC, including Dean, will seek committee approval to relax security restrictions on reactor data.

The present limitations have prevented the release by the commission of any official word on the recent reports by four industrial groups on atomic power. They also would hinder further studies by these groups and by a fifth group which recently began similar surveys.

Evaluation of Project Benefits...

. . . scrutinized by House group. Jones' subcommittee raps USBR, Engineers' method of placing dollar value on indirect benefits

The maze of figures which government agencies use to justify multipurpose waterway projects are just as mystifying to Congress as to the layman.

To make them more understandable, a House Public Works subcommittee last week recommended a more systematic method of presenting the figures to be used in evaluating the projects. The recommendation came in another hard-hitting report of the House group headed by Rep Robert L. Jones, Jr. (D.-Ala.)

Closer Control Asked . . . Like the report on cost allocations released the previous week (EW, Dec. 22, p 8), the recent report calls for closer Congressional control over Army Corps of Engineers and Bureau of Reclamation, which build a large share of the federal civil works projects.

If adopted, the recommendations of the subcommittee should prevent construction of a number of marginal projects and give the government a better balanced civil works program. In computing the direct benefits of the hydroelectric portion of a multipurpose project, the committee recommends that in no case should the value exceed probable revenue from energy to be produced.

Indirect Benefits . . . At present Bureau of Reclamation now includes among its indirect benefits savings of consumers in purchasing government-produced power and use of such power sold to power companies for resale in the final production of goods and services.

The report on economic evaluation of waterway projects takes a hefty swing at the time-honored cost-to-benefit presentation of the two construction agencies. General idea of this formula is that a project is justified if it can be shown that benefits to be derived exceed the construction and operating costs.

Such a figure can be informative, said the subcommittee, "but the present trend seems to be toward development of a figure which would be more deceptive than helpful." It is possible to make fairly sound estimates on benefits to be derived from flood control, hydroelectric, and navigation portions of a project, but the less direct benefits such as recreation, aiding the national economy are impossible to calculate.

Concludes the committee: "Some of the efforts to place monetary values on indirect benefits is nothing short of ludicrous."

Recommendations . . . To keep the justification figures on sound ground, the committee recommends that the constructing agencies stick strictly to project costs and tangible benefits and that benefits should be presented separately with such estimate of their monetary value as may appear realistic.

Thus Congress will be faced with the decision of choosing the project to be constructed without the handy excuse of a favorable ratio formula which sometimes detracts from a project's true national value.

In the course of its economic evaluation study, the subcommittee turned up a number of specific examples to illustrate present practices. For instance, in connection with a preliminary survey of a harbor improvement at Belhaven, N. C., Corps of Engineers spent $6,463 on the survey, which recommended a project costing only $13,500.

This subcommittee report along with three others comes from a study lasting more than a year. Life of the subcommittee is due to expire with the 82nd Congress, but one of its recommendations is that a similar group continue its study of the federal civil works program.

Index Is Available

Electrical World's semi-annual index for July-December 1952 has been prepared and copies are now available upon request. They may be obtained without charge. Address requests to Electrical World, Editorial Office, 330 W. 42nd St., New York 36, N. Y.

CEICo Employee Is Killed in Underground Explosion

Cleveland Electric Illuminating Co had its second fatality in 43 years in underground lines recently, when a freak accident caused the death of one CEI employee and critical injuries to two others.

The accident happened this way:

National City Bank Building voltage was being increased from 4,600 to 11,000 v. Work had been completed to make the switch and about 2 am the morning of Dec. 17 a CEI crew went into an underground vault located beneath the Hollenden Hotel to put the line in service. A spare cable had been used while work was going on to supply the Hollenden and several other buildings in the area. When the crew switched the spare cable off to throw the new line into service, the oil switch apparently misfired and instead of quenching the arc, the oil in the switch carbonized and exploded, killing one of the crew and critically injuring the other two men.

The accident was termed freak because trouble is seldom experienced with oil switches. The last time any trouble developed with an oil switch on its system was in 1913, CEI says. The company's last fatal accident in underground lines was 43 years ago, last overhead fatality in 1948.

Little damage was done by the fire, though it put the Hollenden's control board out of action and interrupted service in an area of several blocks for about 30 minutes.

USBR, Utah P&L Vie for Plant

Both Reclamation and utility offer proposals at public hearing for construction of hydro facility at Deer Creek Dam

Proponents and opponents of "public power" had their innings at Provo, Utah, Dec. 11 in a one-day public hearing on alternate proposals for construction of a small hydroelectric generating facility at Deer Creek Dam.

The case is seen by private power as a clear-cut effort on the part of the federal government to insert itself into the power-generating business in competition with existing private companies. On the reverse side it is being hailed by municipalities having their own systems as a sincere federal effort to uphold consumer needs against the desires of a private utility.

As outlined by E. O. Larson, regional director of the Bureau of Reclamation, in the public hearing held at the Utah County Courthouse at Provo before E. P. Eardley, chief engineer, Division of Water and Power, U. S. Department of Interior, "power production is incidental" to the Provo River Project, which is to supply storage water to the Provo-Salt Lake City area for irrigation, municipal and industrial use.

Contract Obligation . . . A power contract, dated 1938, is basic to the Provo River Project and the related Weber River Project, and is extremely complex. Attention at the public hearing was centered on a provision under which the Utah Power & Light Co agreed to permit the United States, and the Weber and Provo River Association to use all power water originating on the Weber above the older Echo Reservoir—providing that resulting power losses at the Weber and Riverdale plants of the UP&L are "made up" by the United States and/or the Provo Association.

Since the feasibility of the irrigation-corollary use provisions of the Provo River Project were based on an estimated average annual yield of 100,000 acre-ft of storage water, it can be efficient only if all power-water under the 1939 contract is diverted from the Weber to the Provo River. A power plant at Deer Creek Dam is thus considered an essential part of the project for making up winter power losses at the Weber and Riverdale UP&L plants.

Dam Built in '41 . . . Deer Creek Dam itself was completed in 1941, and its related aqueducts bringing water to the Salt Lake Valley are likewise now virtually complete and in use. Power plant provisions were incorporated in the original design, and penstocks and outlet works were designed in suitable fashion, with a power plant substructure built for two generating units.

However, due to war contingencies, and later failure of Congress to act, the power plant as originally contemplated has not been built.

Recent studies, according to Larson, indicate 5,000 kw would be the most economical capacity installation. Bureau figures, based on 1921-1950 water supply records indicate an average annual generation of 26,780,000 kwhr; annual replacement and losses average of 8,245,500 kwhr, and an average annual salable energy of 18,534,500 kwhr.

Bureau Plan . . . Larson told the public hearing bureau estimates show a $990,000 cost to construct the power plant with two 2,500 kw units, substation, tie-line and operators' houses.

Bureau studies indicate the annual average surplus of 18.5-million kwhr could be sold for 5.5 mills per kwhr. This sales rate would repay the power plant cost in 17 years, after which all net operating revenues, estimated at $76,520 per year, would be credited to the Provo River Water Users Association account for repayment of the project costs other than the cost of the power plant. Over the 70-year period estimated for the return of all project costs to the government for the entire Deer Creek Division, the total amount credited to the association from the plant would be $4,366,400.

"What these figures actually show is that the power plant is worth in excess of $70,000 as an average annually to the project," Larson said.

UP&L Plan . . . Meantime, the Provo River Water Users Association has given support to a plan to permit UP&L to build and operate a $600,000 hydroelectric plant at Deer Creek. Fisher Harris, general manager of the association, sees a $1.1-million cost for the government plant, as against a utility company plant for a single 5,000 kw generator costing $600,000. The UP&L program is set up to repay at least $40,000 annually to the water-users to maintain and operate the plant.

Harris has argued that the government would retain ownership of the plant if built under the bureau plan, whereas the water users would have title to it under the UP&L program in 50 years after paying it out under the $40,000 annual revenue scheme.

He likewise has declared the UP&L figure means $40,000 a year above plant amortization charges annually, as compared to $27,000 annually under the government proposal. In addition, E. M. Naughton, assistant general manager of UP&L has pointed out that the utility could proceed with its plan immediately as part of its $15-million-a-year expansion program. There seems little doubt, meanwhile, that to follow the government plan might mean further delays, due to the changeover in Congress and the administration.

Setting Up Poles

Setting poles from a work train equipped with a 110-ft boom was an expedient used by British Columbia Electric Co in building a 16-mile, 66-kv line. The line runs from the company's Bridge River hydro plant to the village of Lillooet, about 110 miles north of Vancouver. Because of the rugged terrain, horses were used to take in equipment and during stringing operations on 60% of the line.

1934 UNSIGHTLY OVERHEAD construction in the business district of Roanoke, Va. was responsible for the changeover to the semi-underground system

1937 SEMI-UNDERGROUND system eliminates unpleasant sight of crossarms, transformers, and numerous primary and secondary wires at street intersections

TODAY'S MODERN UNDERGROUND eliminates all overhead construction

Semi-Underground In Roanoke Defers

Semi-underground benefits approached those of full underground and kept construction expenditures in line with revenue

J. L. WHITE, Division Supervising Engineer, Appalachian Electric Power Co, Roanoke, Va.

A semi-underground system constructed as an interim step in the transition from an open wire overhead to a full underground system in downtown Roanoke, Va., netted Appalachian Electric Power Co these benefits:

1. Appearance of the business district was improved.
2. Outages at times of fires and fire fighting hazards were eliminated.
3. A full underground system was delayed until the load increased and became concentrated.
4. Investment for a full underground system was delayed until it was economically feasible.

Conversion from the open wire system to the so-called semi-underground was started in 1936 (EW, Aug 28, 1937, p 63). At that time calculations showed that if full underground could be delayed five years, substantial investment savings would be realized. The semi-underground system actually delayed full underground an average of 12 years. In this interval, load in the business section increased from 2,000 kva in 1936 to 10,000 kva when full underground was completed in 1951.

Sixteen of the 30 vaults in Roanoke's present underground system were built during the semi-underground program at a cost of $1,500 each. Those constructed just before and during full underground construction averaged $7,500 each. This difference in cost resulted in a saving of $120,000 to the utility.

During the transition to semi-underground, primary wires and cross arms were replaced by aerial cable. All secondary wires were removed from street intersections except the street light pilot wire, which also acted as a pole-to-pole guy. Further improvements were made by installing stack type, three-phase transformers, below 112½ kva, on the poles without using crossarms. Higher capacity transformers were installed in vaults. At the same time the secondary voltage in the business district was changed from 120/240v, single phase and 240v, three phase to 120/208v, three phase.

Tubular steel poles that carried the overhead wires served an important function during the conversion from

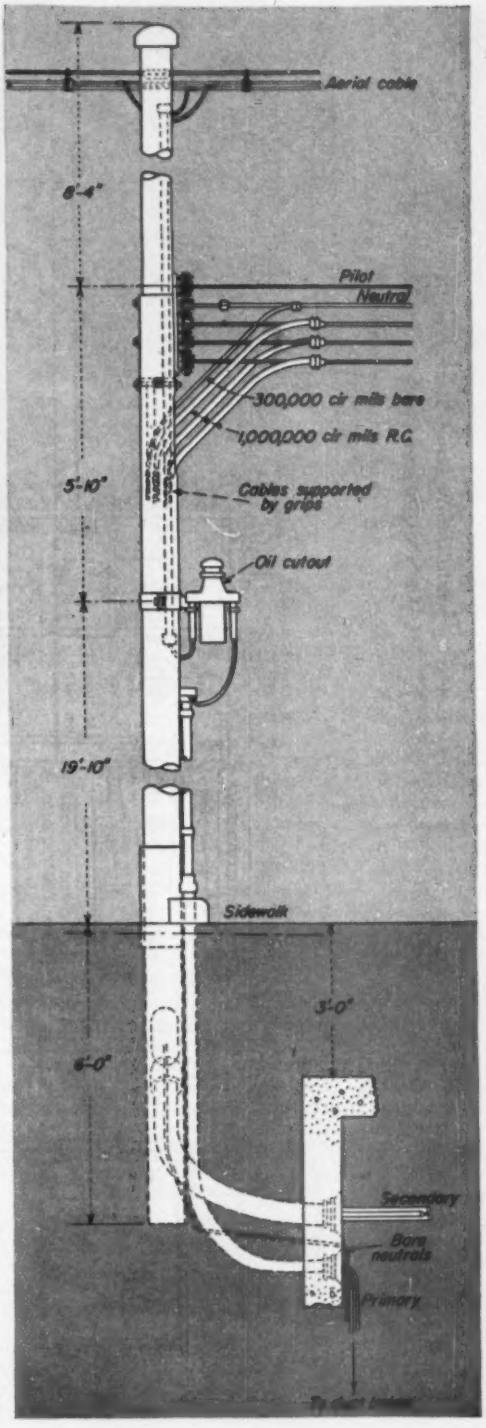
with exception of street light standards. Standards mount 21,000-lumen, mercury vapor lights that illuminate streets to 2.5 ft-c

Full Underground

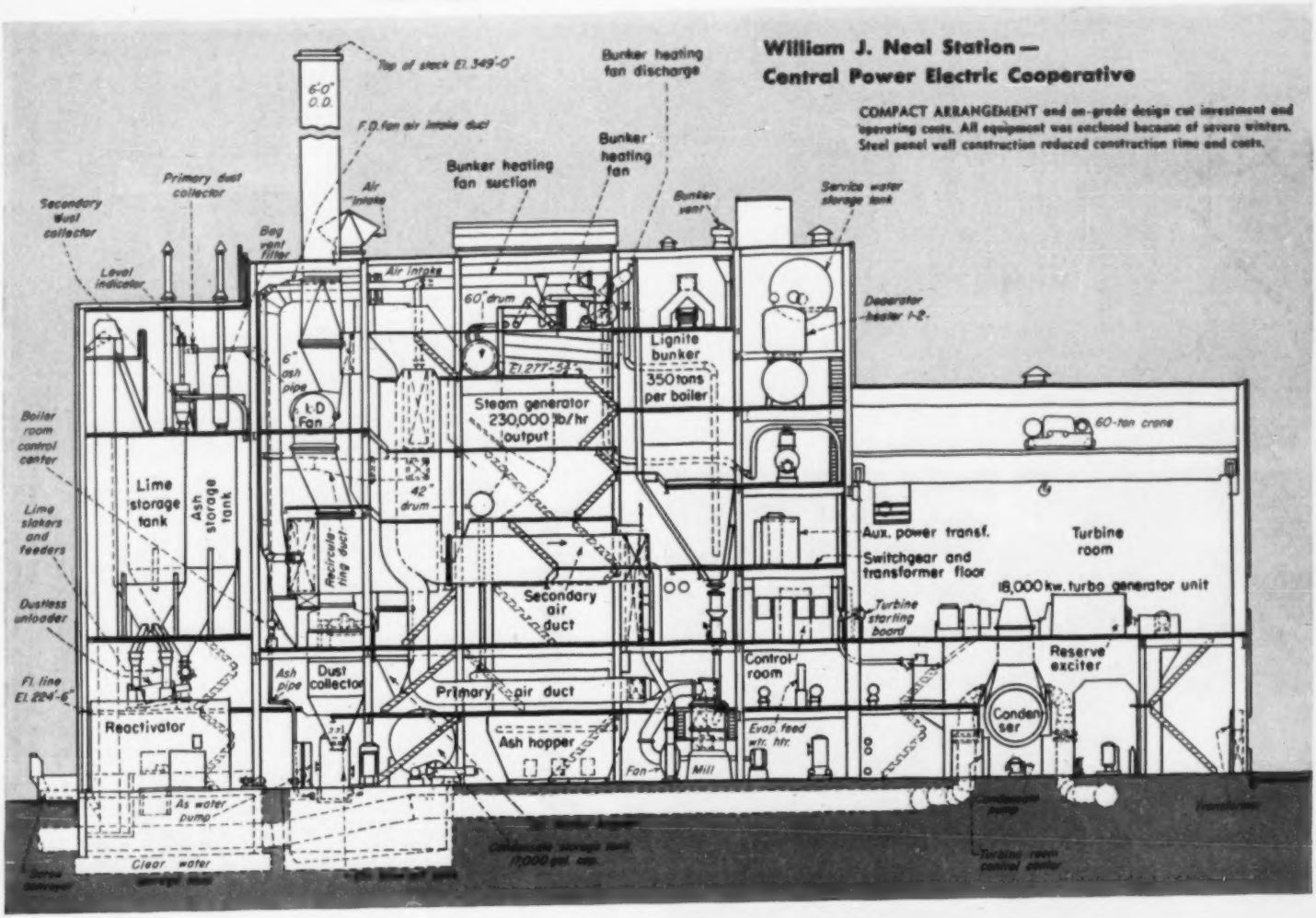
overhead to underground. They were used as conduits for secondary risers from the vaults and underground services to the over head secondary. This reduced the cost of cutting over services.

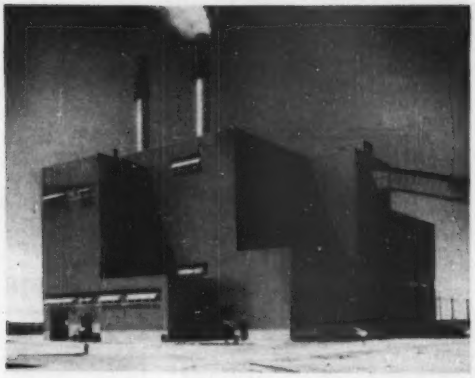
Fortunately, during the conversion many owners of large buildings which would require major rewiring jobs wanted underground services prior to installation of ducts. A plan was worked out whereby the customers changed their services and ran the necessary cable to small service boxes at the base of the tubular poles. The company installed the service boxes and ran secondary from them, through the tubular poles, to the overhead. When the duct work was completed in 1951, the service boxes were included in the underground system at a minimum cost.

The present underground system is supplied by four 12-kv feeders from two substations, one at each end of the business district, 1/3 mi away. Each feeder (300,000 cir mils, PILC cable) is supplied by a 5,000-kva, three-phase, LRC transformer. Vaults are equipped with a network protector; an oil switch; and single-phase, network transformers. All equipment in the vaults is submersible because of flash floods that this city experiences.



TUBULAR STEEL POLES were used as conduit for secondary risers in semi-underground system


William J. Neal Station—
Central Power Electric Cooperative
COMPACT ARRANGEMENT and on-grade design cut investment and operating costs. All equipment was enclosed because of severe winters. Steel panel wall construction reduced construction time and costs.
Top of stack El. 349'-0"
6'-0" O.D.
F.D. fan air intake duct
Bunker heating fan discharge
Bunker heating fan suction
Bunker heating fan
Bunker vent
Service water storage tank
Primary dust collector
Secondary dust collector
Bag vent filter
Air intake
Level indicator
60" drum
Deaerator heater 1-2
6" ash pipe
I.D. Fan
El. 277'-3"
Lignite bunker 350 tons per boiler
Steam generator 230,000 lb/hr output
60-ton crane
Boiler room control center
Lime storage tank
Ash storage tank
42" drum
Recirculating duct
Lime slakers and feeders
Aux. power transf.
Switchgear and transformer floor
Turbine room
16,000 kw. turbo generator unit
Dustless unloader
Secondary air duct
Turbine starting board
Fl. line El. 224'-6"
Ash pipe
Dust collector
Primary air duct
Control room
Reserve exciter
Reactivator
Ash hopper
Evap. feed wtr. htr.
Condenser
Fan
Mill
As water pump
Clear water
Turbine room control center



CONSTRUCTION TIME and building costs were reduced substantially by resort to steel panel wall construction as a substitute for brick

Co-op Plant Produces Low-Cost Power From Lignite

Lignite pulverized and burned without pre-drying in compact plant arrangement cuts investment and operating labor costs. Steel panel walls reduce building time and costs

A. C. SODERHOLM, Partner and Mechanical Engineer
F. D. TROXEL, Partner and Senior Electrical Engineer
Vern E. Alden Co., Engineers, Chicago

The William J. Neal station of the Central Power Cooperative is located on the edge of a vast lignite field near Voltaire, N. D. Availability nearby of this low-grade fuel offered a challenge to station designers. In accepting it they faced the task of laying out a two-unit plant of 30,000-kw initial capacity that would burn lignite having upwards of 35% moisture while holding fuel preparation costs to a minimum by pulverizing the lignite without pre-drying.

To determine whether North Dakota lignite with this much moisture could be pulverized and burned satisfactorily in a water-cooled furnace to produce 150,000 to 200,000 lb of steam per hour, several carloads of lignite were shipped to a power plant at Nekoosa, Wisc. Here Combustion Engineering Co had a powdered-fuel-fired boiler installation with water-cooled furnace walls and preheated air for combustion. Bowl-type pulverizing mills were also available.

At this plant a shift was made from Illinois coal to Valva lignite, which when pulverized has a heating value of 6,810 Btu per lb as mined and this approximate analysis:

Moisture	37.8%
Volatile	26.6
Fixed carbon	30.4
Ash	5.2

For the test, primary and secondary air was adjusted and the boiler continued to carry load without losing ignition. Fuel air temperature to the burners was low as was expected, since combustion air was heated to only 515F. The test was continued long enough to obtain data and make visual observations of furnace conditions necessary for designing a furnace and burner equipment for the 230,000 lb per hr steam generators required for the new station.

Steam Generators . . . Lignite at Neal station was to be burned in two steam generator units each to deliver 230,000 lb per hr at 850 psi 900F and having its own forced-draft and induced-draft fan, mechanical dust collector, and three pulverizers.

Design called for each pulverizer to handle 20,000 lb of lignite (42% moisture) per hour and deliver it at a fineness of 70% through a 200-mesh screen.

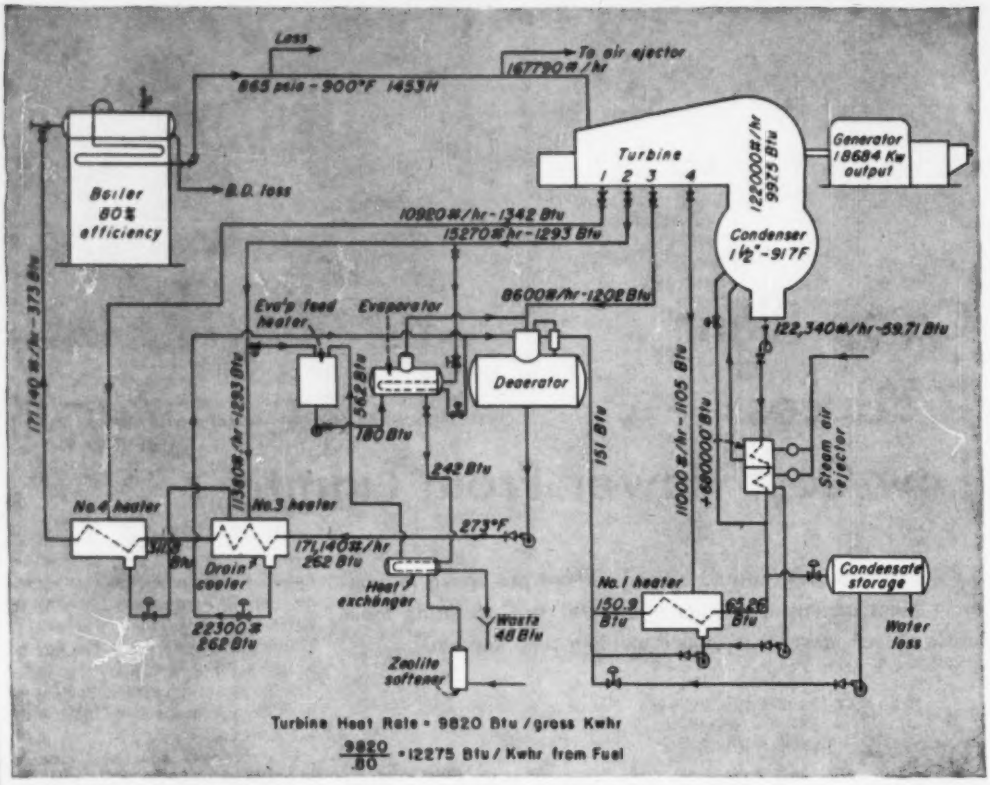
Steam temperature was required to be held at 900F from 150,000 to 260,000 lb per hr maximum flow by a spray de-superheater using boiler feed water for cooling.

Heat recovery equipment consists of a special tube-type air pre-heater. Arranged for counter flow of gas and air, the heater has a hot and cold section and four passes for all of the air and a fifth pass for primary air that is located at the hot gas inlet end of the heater. Secondary air is heated from 80F to about 595F and primary air to 675F; gases are cooled from 755F to 360F.

Lignite is delivered to the plant in 70-ton bottom-dump railroad cars which belong to the power cooperative. Cars come in over the mining company's railroad, using mining company's locomotive. Cost of delivery is included in the fuel contract.

For storing the lignite a diesel-powered tractor and bulldozer were provided. Since this type of fuel oxidizes and disintegrates rapidly when exposed to air, and since the plant is close to the mine, only a limited amount of lignite will be stored

Lignite and ash can be handled in one eight-hour shift. Each bunker has a 350-ton capacity, sufficient for more than 20 hours of normal operation. Therefore only a one-shift fuel-handling crew was required.



GOOD EFFICIENCY is realized. Steam is extracted from four points in turbine for make-up for the system

For ash handling a hydro-pneumatic system was provided that takes ash from the hopper and boiler passes to a steel storage tank where it is fed through a dustless unloader to trucks for transfer to an ash-disposal area.

Other Plant Features . . . Beyond the requirement that the station be laid out to burn pulverized lignite several other design objectives found expression in the final arrangement of the plant. Among them were:

1. That arrangement of equipment be compact, to reduce investment operating cost and manpower.

2. That substitutes for brick be used in building walls to save construction time and expense.

The compact arrangement of equipment in the plant has made it possible to operate the plant with a minimum of four men. Time for maintenance work has been held to a minimum by provision for free access to the equipment.

The plant is an on-grade design using a cooling tower for condensing water. The extremely cold winters in North Dakota made it desirable to enclose all equipment. Turbine and condenser are supported by conventional concrete foundation. Boiler columns support the building structure in the area surrounding the boilers. Foundation conditions permitted use of spread footings for building structure and equipment. Use of stainless steel insulated wall panel construction expedited building during winter months, advanced the completion date of the project, and reduced investment.

Station Layout . . . Steam generators were placed in a row paralleling the turbines. Cooling towers were arranged so that the prevailing north wind would carry vapor away from the station and switchyard during the winter months. Lignite handling equipment was placed at the east side of the station where dust will not be carried into the switchyard or cooling tower.

The central control room is on the main operating floor between the turbine room and boiler firing aisle. It is so arranged that the operator can observe both turbines and boilers without leaving the room. In it are located all controls for boilers, turbines, and the principal electrical equipment, including the outgoing transmission line. Glass doors and windows permit the operator to observe movement of assistant operators on the floor of turbine and boiler rooms.

Control boards are all of the vertical type except the electrical control boards for turbine and boiler auxiliaries. These were made bench type in order to provide window space for viewing the boiler and turbine rooms.

Turbine Generators . . . The plant's two 3,600-rpm steam turbine-genera-

tors are located on the operating floor. Generators are rated at 15,000 kw, 0.80 pf, 18,750 kva with a 0.5 psi hydrogen pressure, or 21,565 kva at 15 psi hydrogen pressure. They are wound for 13,800 volts and employ direct-connected 250-v exciters, 125-v pilot exciters, and rheostatic-type voltage regulators.

Steam conditions for the single-cylinder, 17-stage condensing turbines are 850 psi, 900F and 1½ in. absolute back pressure. Turbines have high-capacity overload valves. Each has capacity to generate 21,500 kw when extracting steam for four stages of feed water heating.

Plant Cycle . . . Steam is extracted from four points in the turbine for feed water heating and evaporating make-up for the system. Condensate is deaerated in a direct contact heater. One of the high-pressure extraction heaters has a built-in drain cooler.

Each unit has two condensate pumps. Three boiler-feed pumps and three circulating pumps were installed, one of each being a standby for the other two. Coolers for hydrogen, oil, and bearings are supplied from the plant make-up well water system. The well water is given a cold lime, alum and acid treatment before it passes through the coolers on its way to the condensing water system. Feed water is treated in a sodium zeolite softener before it goes to the evaporator open feed water heater.

Cooling Water . . . Condensers for the turbine are located under the turbine foundation, above the basement floor line.

Condensing water is cooled in a 34,000-gal capacity induced draft cooling tower with 14F approach to the wet-bulb temperature. The water is returned to the condensers by three circulating pumps, two of which are used simultaneously when two condensers are in service.

Switching . . . Power generated at 13.8 kv is sent out from the station over two 115-kv Bureau of Reclamation transmission lines and three 41.6-kv Otter Tail Power Co transmission lines. The Otter Tail system is tied in with the 115-kv Bureau of Reclamation lines. Otter Tail will do the load dispatching for the entire system.

Phase isolation of main generator leads is provided. Connections from the generators to the step-up power transformers are metal-enclosed bus, from the generators to the building wall. Outside the building wall, these connections to the transformers are single-conductor insulated cables in conduit, underground.

Auxiliary Power Supply . . . The auxiliary power for each unit is provided by a unit auxiliary transformer connected directly to the generator leads. Two three-phase auxiliary transformers step down from 13.8 kv to 480 volts. Each has a self-cooled rating of 1,750 kva and a fan-cooled rating of 2,186 kva. They are of the dry type with class "B" insulation and are located indoors adjacent to the auxiliary switchgear.

Reserve auxiliary power supply is provided by a 1,750-kva three-phase, outdoor station auxiliary transformer which takes power from the 41.6-kv bus. Fans increase the rating to 2,000 kva.

Power for essential auxiliaries for each unit is taken from the 480-v bus for each unit. Each essential motor is supplied through an individual electrically operated, remote controlled, air circuit breaker.

Power for the less essential auxiliaries is taken from the 480-v station bus which is normally supplied from the reserve auxiliary transformer.

All of the larger motors are 440-v, three-phase. The smaller motors are 220-v, three-phase, and are supplied through step-down transformers from the 480-v buses.

All breakers inside the building are of the air break type and all transformers installed indoors are of the dry type.

Very little conduit has been used in this station. All power and control cable, except the main generator leads and the main transformer leads, are carried in a cable pan system which extends throughout the station. The elimination of most of the conduit work resulted in a considerable saving in the cost of the station.

CENTRALIZED CONTROL ROOM has vertical boards except electrical controls for turbine and boiler auxiliaries

Low-Cost Power from Char?

Olin interested in using coal residue as fuel to produce power for aluminum plant. Consol building pilot plant

Char—a coal residue—may be one key to the low-cost electric power which aluminum producers need.

At any rate, it is attracting the serious attention of Olin Industries, Inc, which recently received government approval of a proposed $174-million aluminum production and fabricating plant (EW, Dec. 1, p 169).

One of Olin's big problems is to find a source of low-cost electricity to supply some 250,000 kw of capacity which it will need for aluminum production. Since there is hardly an area in the country with that kind of cheap surplus electric power, it looks as if Olin will have to build its own generation facilities. Because it will have to compete with established producers using low-priced government produced power, Olin must find some cut-rate way to produce its own power.

Builds Pilot Plant . . . Pittsburgh Consolidation Coal Co believes it has the answer. Its researchers are putting the finishing touches on a pilot char-producing plant. The char, it is believed, is just the fuel Olin is looking for. This type fuel is the residue of high-grade metallurgical coal, from which many of the chemicals have been removed.

If the pilot plant works, and Consol is sure it will, a full scale model will be used to produce fuel for the Olin power plant.

Monongahela Plant . . . Plans are already well along for the Olin aluminum facilities, and these incorporate the use of char for power production. As presently conceived the Olin plant would be located on the Monongahela River between Fairmont and Morgantown, W. Va. This would give easy access to the high-grade coal needed for char production.

The plant would include the char and chemical producing facilities, the electric power plant, an aluminum reduction plant and a fabricating mill. Present plans call for Olin to operate the power facilities. As far as can be determined, there is no arrangement for the operation or ownership of the char plant.

If Olin does decide in favor of the new type fuel, it will mark the first time that char has been used on a large scale by any American industry. German scientists carried on extensive experiments with char from low-grade coal such as lignite, but Consol has pioneered in carbonization of high-grade coal.

Char, Chemicals from Coal . . . A char-producing plant is essentially a huge retort in which coal is burned under forced draft. The high-grade coal is continuously forced into the bottom of the retort and chemicals are driven out the top in gaseous form. Char is forced out a side opening in the retort, and may be carried by pipe to a point of use or storage.

By controlling the temperature and pressure in the retort, the operator determines the proportion of chemicals and char produced. Where large amounts of char are required, the high-grade coal can be turned into 80% char and 20% chemicals.

Because the by-product chemicals have a high value, the price of the char is considerably lower than conventional boiler fuels.

Live Energy . . . Coming from the retort at a temperature of some 950 deg F, the char brings a lot of live energy with it. It can be cooled and

Progress at Wabash River Station

Construction work is progressing rapidly on Public Service Co of Indiana's Wabash River Station. Crib house for units three and four is shown in foreground and for units one and two in background. Each unit will have a capacity of 90,000 kw. First one is due to go on the line in March 1953 and the second in July. The third and fourth units will follow within 12 months. Substation will tie plant into Public Service's transmission system through 230-kw, 132-kv, and 33-kv circuits.

later transported to the point of use. However, planners are talking now of piping the char directly to the fireboxes of the electric generating plant. This would conserve a large part of the live energy for use in the boiler. This temperature would be raised in the firebox as combustion is again accelerated.

Co-ops Asked to Use Loan Funds or Release Them

Rural electric cooperatives holding government loan agreements are being asked either to make use of the funds available or rescind the agreements.

Purpose is to release funds to co-ops which have an immediate need for money. With more than six months of the present fiscal year to go, Rural Electrification Administration has already approved loans of $66 million. This is more than half of the $118 million available for such loans this fiscal year. Another $50 million contingency fund is theoretically available for such loans, but REA has an understanding that this is to be used only as a last resort.

A complicated state-by-state allocation formula which REA administers further restricts the amount of money which can be loaned to co-ops.

In an effort to release funds currently tied up in loans which are not being used, REA recently sent out letters to individual co-ops asking them to rescind the loan agreements if it appeared no use would be made of them. The letters went to a number of generating and transmission cooperatives, including the Old Dominion Electric Cooperative of Virginia which holds a loan approval of $16 million.

Finland Plans Expansion

HELSINKI (McGraw-Hill World News)—Finland's latest hydroelectric power station building program is designed to give the country a total electricity output of 6,485 million kwhr a year by 1956. Present hydroelectric output is 4,625 million kwhr a year. The principal stations to be constructed under the program are Jumisko (100 million kwhr a year), Monttakoski (210 million), Pamilo (230 million), Utakoski (270 million), and Petaejaeskoski (400 million). Work on the Jumisko, Monttakoski, and Pamilo stations is well advanced and they are expected to be in operation at the end of 1954. Utakoski and Petaejaeskoski stations will be finished by 1956.

Another phase of the development program is the extension of a number of existing stations, such as Tainionkoski, Imatra, Kuusankoski, and Mankala. Meanwhile, a number of power stations begun under an earlier program will be ready for operation next year. The main ones are: Paelli (275 million kwhr per year) and Noujua (465 million kwhr per year).

Output figures show the advance already made in hydro production in Finland. From 2,500 million kwhr in 1944, output rose to 4,160 million in 1950, 4,550 million in 1951 and an estimated 4,625 million in 1952.

Besides the development of hydroelectric power, Finland also plans to double steam power output by '56.

This much of SPA's output went to preference customers during fiscal 1952:

(Energy in Kwhr)

Project	Generated*	Firm-Energy Available	Marketed to Preference Customers	Per Cent of Firm	Marketed to Co-ops	Per Cent of Firm
Norfork	338,925,200	116,900,000	58,651,200	51	48,355,200	42
Narrows	42,526,930	18,400,000	6,207,906	34	6,207,906	34
Denison	142,560,000	140,000,000	96,565,955	69	81,493,269	58**
Totals	524,012,130	274,400,000	161,425,061	59	136,056,375	50

*Secondary and dump energy included in this column cannot be used by preference customers; it must be absorbed by the larger systems of the private utility companies as fuel replacement.

**Of the 70 million kwhr of firm energy available from Denison for marketing in Texas, rural electric cooperatives in that state received 51,844,883 kwhr, or 74%.

This much of SPA's capacity was earmarked for preference customers during fiscal 1952:

(Capacities in Kw)

Project	Installed Capacity	Firm Power Capacity at 50% Load Factor	Marketed to Preference Customers	Per Cent of Firm	Marketed to Co-ops	Per Cent of Firm
Norfork	70,000	26,484	11,650	44%	9,150	35%
Narrows	17,000	4,291	4,065	97	4,065	97
Denison	70,000	31,963	28,310	89	20,725	65*
Totals	157,000	62,648	44,025	70	33,940	54

*Output of one generator of Denison Dam is marketed exclusively in Texas. Through integration contract with Texas Power & Light Co, SPA makes available to rural electric cooperatives in that state 20,000 kw, or 125% of the generator's firm power capacity at 50% load factor.

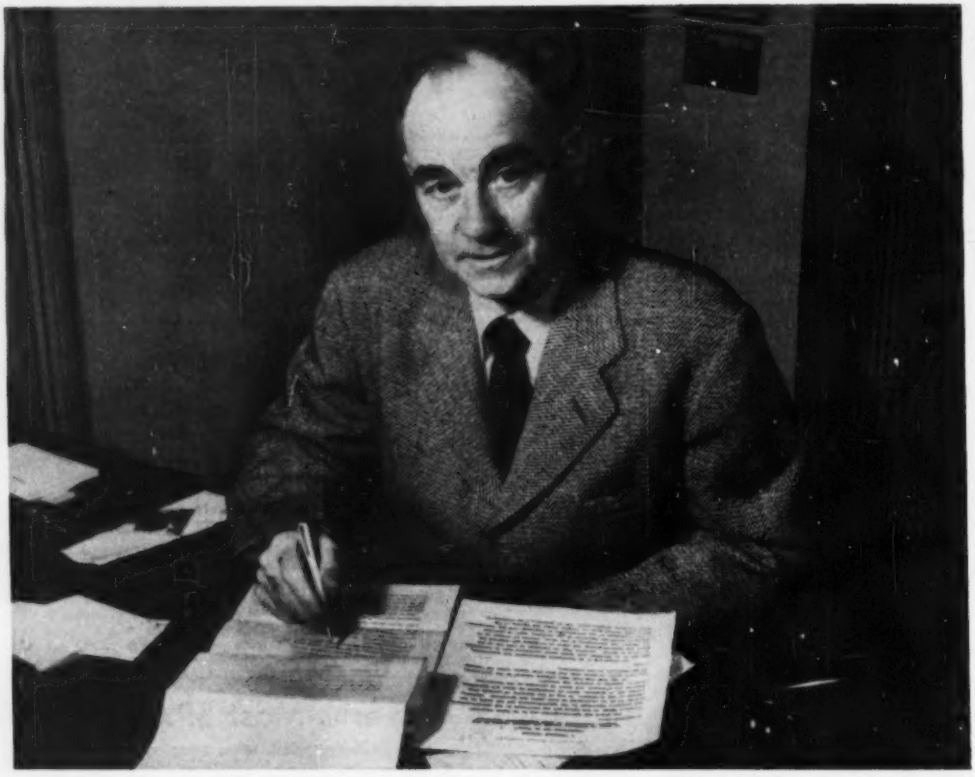
'Preference' Governs Most SPA Sales

"It can be predicted with confidence that, upon completion of arrangements now in progress or contemplated, very nearly all of the firm power and energy generated at federal government projects in the Southwest will be marketed to preferred customers, with a large percentage going to rural electric cooperatives."

The quote is from a report released by Douglas G. Wright, Southwestern Power Administrator, discussing "percentage of federal power going to preference customers in SPA area."

He gives as the basis of his estimate the accompanying tables. They show that 70% of firm power and 59% of firm energy marketed by SPA during fiscal year 1952 went to preferred customers.

"It is important to note," Wright said, "that these figures have been established during a period when the generation and transmission facilities available to SPA were limited, and that a great deal of opposition to our program has been encountered during this time."



Contractors Discover the Values of Selling

Traditionally, electrical contractors have merely bid for jobs. Now they are realizing they have much to sell

EDWARD J. WHITE, Edward J. White Co, Newark, N. J.

Use of electricity in every phase of this country's economy is rapidly increasing. In the past five years (1947-1952) electricity generated has increased over 50%. If that rate of increase continues an output of a trillion kwhr will be reached by 1965. The increase since 1947 was mostly caused by conditions and forces external to the electrical industry. The "if" that reaches to a trillion kwhr by 1965 cannot count on those external causes; it must put its reliance on the only force the industry can apply. That force is selling—selling by the whole industry, the ultimate in team work, with the electrical contractor doing his share.

In 1952, the dollar volume of the electrical contracting business was much more than $1.5 billion. This figure is arrived at by calculation from the amount 11,528 electrical contractors paid into the pension fund for their 109,049 employees who are members of the International Brotherhood of Electrical Workers. This $1.5 billion is a minimum figure because many contractors do not employ union labor and do not contribute to the fund. Allowing for this and other exceptions, one can estimate, perhaps over-generously, that electrical contracting in 1952 was a $3 billion business.

This is big business. But it can be, should be, much bigger. And it will be much bigger if the tremendous selling job that faces the electrical industry in the immedi-

ate years ahead is carried on successfully. To this selling job the contractor will contribute his share of effort, according to plans now in hand.

When the peak of defense spending is passed, probably around the middle of next year, the manufacturing capacity of the nation will become more and more available for production of civilian goods. These goods will have to be sold, put to use in American homes, farms, stores, offices and factories.

A considerable proportion of this impending flood of production will be sold against the competition of a correspondingly large volume of other consumer goods. The electrical industry will have to work hard for its share of the buyer's dollar.

For over 50 years the electrical contractor has been selling his services as best he knew how. And his best has been much less than good. It has been so because it is based on one single concept of selling—price. He has gone along on the theory that the way to get a job is to offer to do it at a lower price than that of his competition.

More Than Low Bidding

The time has come for the contractor to learn that selling is a whole lot more than just making a low bid. When he does learn, there will be no occasion for people to read in the public prints words like these:*

"Electrical contractors are jamming up the bright new household appliances with their long whiskers.

"Seems that any Joe can get into electrical contracting if he's a qualified journeyman. This means that many a small contractor has old-fashioned, if not downright atrocious, ideas of how to run a business.

"He will talk a customer into putting as little wiring as possible into a house. That way he hopes to make a low bid, get more jobs, rather than sell more per customer."

The electrical contractor is a necessary factor in the electrification of the nation. That he has not contributed his share to the selling effort of the electrical industry in the past is not wholly or very much his fault. Though the volume and the quality of his work are of vital importance to the progress of the electrical industry, he is forced to operate as part of another industry—building construction. And in the construction field he is not a prime, but a sub-, contractor. His opportunities for direct dealing with the party of the first part in a building contract are few, are usually non-existent. He has little or no chance to talk advantages, benefits, values, the considerations that make up selling, that persuade the customer to want something more, something better. He must deal with an intermediary, the general contractor to whom electrical work is only part of a whole that includes masonry, plumbing, plastering, carpentry, all the elements in the complex of construction. And the general contractor looks for low prices in every one of them. Thus forced into the position of relying on price as his best sales argument, it is no wonder that the electrical contractor regards it as his only argument.

This is a condition that must be changed if the contractor is to profit according to the value of his work in the rapidly increasing electrification of America, if he is not to be a stumbling block in the way of that electrification, if he is to do his required part in averting the possible economic letdown that may result from the coming decline in defense production.

Home Modernization Market

Calculating from 1950 Census data, Arthur R. Hines, General Electric commercial vice-president and chairman of the National Adequate Wiring Bureau, estimates that there are in this country over 20 million homes that are prospects for wiring modernization. At $100 per average job—a conservative figure based on actual records—this is a $2 billion market waiting right outside the contractor's door. Add to this the market for adequate wiring represented in new homes construction of up to a million or more a year, and it is clear that in the residential field alone there is enormous opportunity for selling to profit the electrical contractor.

The contractor who fails to see this opportunity immediately has only to think of some contrasts—the 1920 lighting fixture with its two footcandles of the eye-destroying apology for illumination as against the amenity and cheer of modern home lighting; the shinbarking pull chain dangling from the bathroom ceiling as against a wall switch near the door; plenty of convenience outlets as against a tangle of extension cords; overloaded, antique main switches and fuse blocks as against adequate, safe service entrances and branch circuit panels; all the exasperating deficiencies and real hazards that exist in the outdated electrical system of the old but comfortably livable home.

It is not only in homes that such deplorable electrical conditions exist, but also in farms, factories, shops, stores, offices, all the places of business occupancy. In the coming time of intensified competition in the sale of consumer goods, stores that most effectively employ the attraction values of modern lighting and other electrical services will pull in the most customers. With new factories springing up on all sides, turning out goods at low costs with up-to-date production equipment and methods, older plants will have to be modernized in order to stay in operation. A great deal can be, and will have to be, done to raise the efficiency of office workers, using all the resources of improved lighting and mechanization of clerical tasks. All this adds up to a tremendous market in the electrical rehabilitation of existing structures and in providing them with present-day electrical services. And all this, it must be remembered, is plus to the work for the electrical contractor in new construction.

Will Have to Be Sold

There can be no doubt that an almost limitless market awaits the electrical contractor. But it is not a sellers' market. There will be few who will come to the electrical contractor and say, "Give me the works. Equip my premises with every modern electrical facility and hang the cost". The market will have to be sold. Intelligent, aggessive selling that fully informs the customer of every advantage and benefit of fullest use of electricity in efficiency, economy, safety and convenience, will have to be employed.

* Financial Post, Toronto, Ontario, Nov. 8, 1952.

But the average electrical contractor neither has the experience and training that qualifies him to do this kind of selling, nor has he the opportunity to do it. As a construction subcontractor he still must deal with the general contractor who stands between him and the customer, and to whom price remains the prime consideration. There are now some notable exceptions to this general statement and undoubtedly there will be many more as enterprising men become aware of the opportunities around them. But, as an essential component of the electrical industry, electrical contractors are not equipped to do, are practically prevented from doing, as individuals, the selling job that offers so much to them, and that is necessary to the accelerated progress of the industry.

Business Development Program

But what can't be done individually can often be done by organization. Appreciating this truth, the National Association of Electrical Contractors at its convention in Chicago in October authorized a business development program with "five general objectives and five specific targets".

The general objectives are, in brief:

1. Better qualification of electrical contractors for all types of electrical work.

2. Stimulation of the electrical contractor to do the complete electrical job, regardless of size, location or type; and helping him get the business.

3. Correction of evils in the electrical and construction industries. (In the complete statement, some of the evils are listed—"labor only" contracts; materials and equipment furnished by others; below-cost bidding; bid shopping and peddling; recognition of unqualified contractors; chiseling methods used by some contractors in purchasing; poor and inadequate plans and specifications prepared for contractors by architects and engineers.)

4. Discovery and development of new markets for the services of specialty electrical contractors.

5. Expansion of cooperative promotional activities with other branches of the electrical industry.

Summarized, the five specific targets are:

1. The customers of the general contractors, architects and engineers in whose bids are included the work of electrical contractors.

2. The general contractors, architects and engineers—promotion of the specialty electrical contractors' services as a means to help them sell their inclusive services.

3. Industrial and commercial modernization customers and prospects.

4. Home owners and the general public.

5. Utility companies and federal, state and municipal agencies.

To attain these objectives by hitting these targets, 12 distinct lines of attack are planned:

1. National institutional advertising. At the start, at least, this activity will be confined to the placing of "prestige" advertising in a limited number of media, such as "Fortune" magazine, "Business Week" and the "Wall Street Journal." A large number or reprints are to be distributed to members who would use them in connection with their own promotional activities, thus achieving individual contractor identification. This advertising would set a pace for the general program.

2. Personal contact with major purchasers of electrical construction and maintenance for the purpose of selling them on the advantage of using the services of the specialty electrical contractor. This would include direct contact with the national constructor type of general contractor.

3. Local chapter organizations to inform members and to stimulate contractor participation in the program. Chapter business development committees would continually transmit and educate members on all types of promotional programs and materials and develop specific activities.

4. Sell engineering services as well as labor, materials and construction supervision. This is especially necessary in the sale of contractor services to customers and prospects for commercial and industrial modernization. The electrical contractor has the services of a specialist to sell and on many types of work what makes him a real specialist is his ability to integrate design and application engineering.

5. Develop and expand cooperative efforts with the National Adequate Wiring Bureau to sell the public that the electrical contractor is the man to go to for any type of electrical service and is the accredited information center on adequate wiring.

6. Develop in cooperation with the NECA Research and Education Department a survey of market opportunities and problems of line constructors. Determine what the line constructor has to sell and work out a program to help him develop business primarily with the electric utilities.

7. Cooperate with the NECA Research and Education Department to promote contractor educational programs aimed towards attainment of the five basic objectives.

8. Cooperate with the Research and Education Department with suggestions for developing statistical and market data and use, and exploiting such material as it is produced.

9. Continue and expand contact with other branches of the industry, employing "Qualified Contractor" (the Association magazine) and increasing personal contact with industry leaders and participation in joint industry promotional efforts.

10. Engage in spot promotional efforts as occasions arise, including but not limited to publicity activities.

11. Assist in activities to correct evils in the construction and electrical industries that are contrary to the establishment and functioning of sound business development plans, such as are contemplated in this program.

12. Assist manufacturers in their contact with individual contractors in their own industry promotional activities.

The National Electrical Contractors Association does not include in its membership of 3000 all of the electrical contractors in the country. There are many thousands more, some of whom are organized in local associations, but most of whom go it alone. It is these latter to whom the newspaper quotation at the beginning of this article most particularly applies, the self-employed and those with only a few journeymen and helpers employed. But whatever the size of the contractor, a back-alley shop or a large establishment, each one will benefit from the NECA business development program.

Belongs in the Industry

To a very large extent the electrical contractor has been, still is, regarded by the rest of the electrical industry as a sort of stepchild. He is of it, but not in it. This has not always been the case. It was only about 20 years ago,

What the Electrical Contractor Is Up Against

(A humorous version—that comes near to being serious—of the so-called "murder" clauses that often are included in his contracts.)

INTERPRETATION

The plans and specifications are to be taken together. Anything shown on the plans and not mentioned in the specifications, and anything mentioned in the specifications and not shown on the plans, is to be considered as both shown and specified. Anything wanted by the Architect, or any of his friends, or anybody else except the Contractor, shall be considered as shown and specified, implied and required, and shall be provided by the Contractor without expense to anybody but himself.

If the work has been done without undue expense to the Contractor, the work shall be taken down and done over again, until the expense is satisfactory to the Architect.

PLANS

The plans are to be considered diagrammatic and disgraceful, and are to be followed only where space conditions make it impossible to avoid so doing. Anything that is forgotten or left out of the plans and specifications, but which is necessary and required for the comfort and convenience of the Owner, whether he thought of it before or after the execution of the contract, shall be provided by the Contractor to the satisfaction of everybody, except the Contractor, and in full accord with the evident intent and meaning of the specifications, without extra cost to anybody but the Contractor. Anything that is right on the plans is to be considered right; anything that is wrong shall be discovered by the Contractor, and shall be made right without telling on the Architect and without any indication on the bills.

RULES AND REGULATIONS

The work throughout shall comply with all the rules and regulations, caprices and whims of all City, County, State, National and International Departments, Bureaus and Officials, having or not having jurisdiction.

MATERIALS

All materials shall be of the best of their several kinds and the Contractor is expected to know and provide the best irrespective of what is specified in the detail. The Architect reserves the right to change his mind about what is best. Any change necessary to make the work and material fit to the mind of the Architect, shall be made by the Contractor without extra cost.

PERMITS

The contractor shall obtain all permits and shall pay all fees, annual dues, assessments, subscriptions, to masked balls, organization outings and all hat checks.

DAMAGE

Any damage done by the Contractor shall be paid by the Contractor as liquidated damages and not as a penalty.

GUARANTEE

The Contractor shall guarantee, and does hereby guarantee that he will keep in perfect and complete working order, anything that the Architect asks him to attend to, so long as there is more work in sight in the Architect's office.

ARBITER

In case of any dispute arising as to the nature, character, or extent of the work shown, specified or implied, the matter shall be decided by referendum and recall, after which the decisions may be set aside and reversed by the Architect, who shall be the judge, jury, and prosecutor of everybody.

PAYMENTS

Payments, if any, shall be made as the work progresses in the amount of 85% of the value of the work done, as judged by the Architect. In no case shall the judgment of the Architect of what is due the Contractor cover more than enough to meet the Contractor's payroll every Saturday night.

The final payment, if any, shall be made only when everybody is satisfied—except the Contractor who need not be considered.

Any evidence of satisfaction on the part of the Contractor shall be just cause for withholding final payment for the work.

FINALLY

The Contractor shall accept and hereby does accept the conditions hereinbefore and hereinafter appearing, for himself, his ancestors and descendents, his family, his heirs, executors, his ox and his ass, and any stranger that is within his gates.

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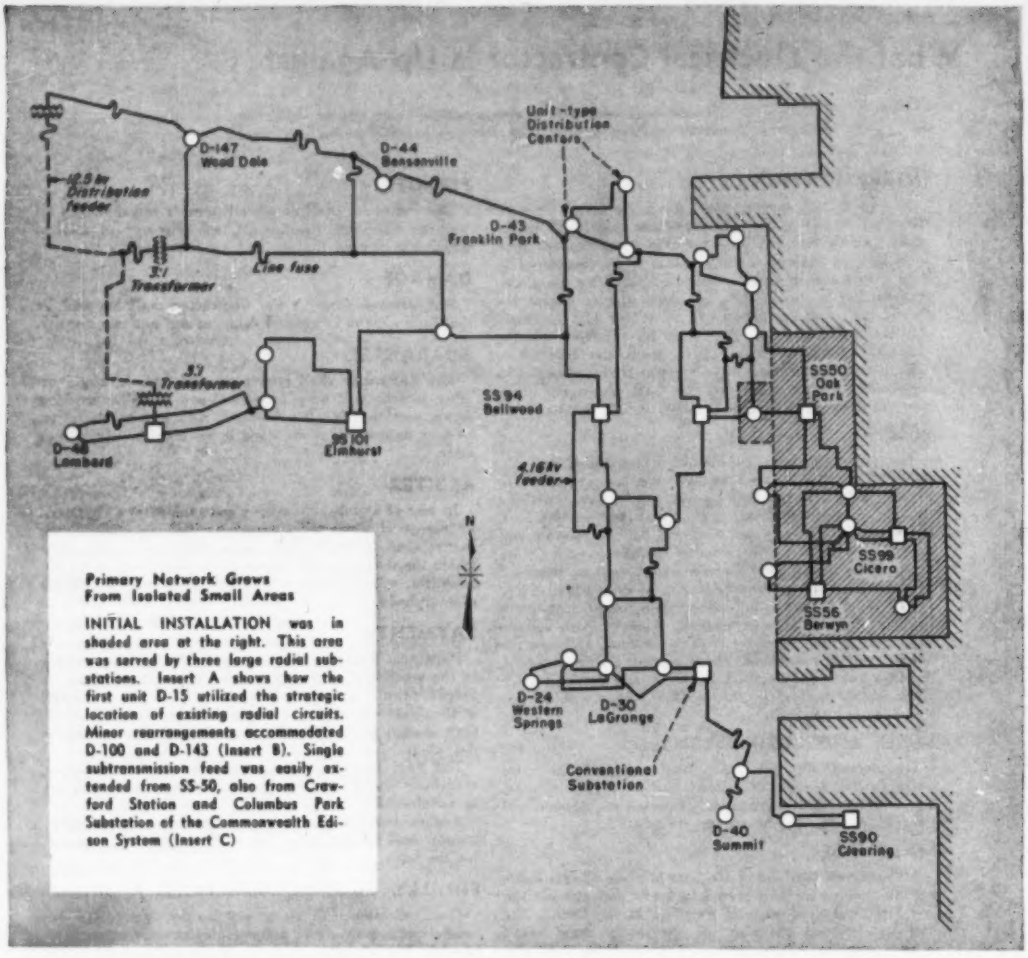
in the days of the unlamented NRA, that the contractor was jerked out of the electrical brotherhood by the scruff of the neck and classified as part of the construction industry. Previously, he had enjoyed full membership in the fraternity. He contributed much to electrical progress, participated in intra-industry activities, and received his reasonable share in the resulting profit. He sold motors and motor controls and much other utilization equipment and was allowed a profit on such sales. He was much more a factor in the industry then than he is now. He is now pretty much only a labor contractor equipped with a certain "knowhow" and a few special tools. The conditions under which he works are set forth above in the somewhat exaggerated paraphrase which was presented by the author at the convention of NECA in 1951.

Every village, town and city in every state has one or more electrical contractors, familiar with every phase of home-town life. The contractor knows the people, the mayor, the school board, the streets, homes, shops, banks, movies, the whole wide market for greater use of electricity. With the proper backing from the other branches of the industry he can add millions of kilowatts to the lines of the utilities and increase the demands for appliances and other utilization equipment, for better lighting, and for safer and more efficient power installations. **The electrical contractor wants to be welcomed back into the electrical industry, to work with it and for it, to do his part in the "Sell—and—Sell—and Sell" job that is ahead.**



Primary Network Grows From Isolated Small Areas

INITIAL INSTALLATION was in shaded area at the right. This area was served by three large radial substations. Insert A shows how the first unit D-15 utilized the strategic location of existing radial circuits. Minor rearrangements accommodated D-100 and D-143 (Insert B). Single subtransmission feed was easily extended from SS-50, also from Crawford Station and Columbus Park Substation of the Commonwealth Edison System (Insert C)

Develop 120-Square Mile Primary

- **Provides firm capacity with minimum reserve**
- **Improves reliability of service**
- **Reduces power loss and voltage problems**
- **Makes immediate full use of new investments**

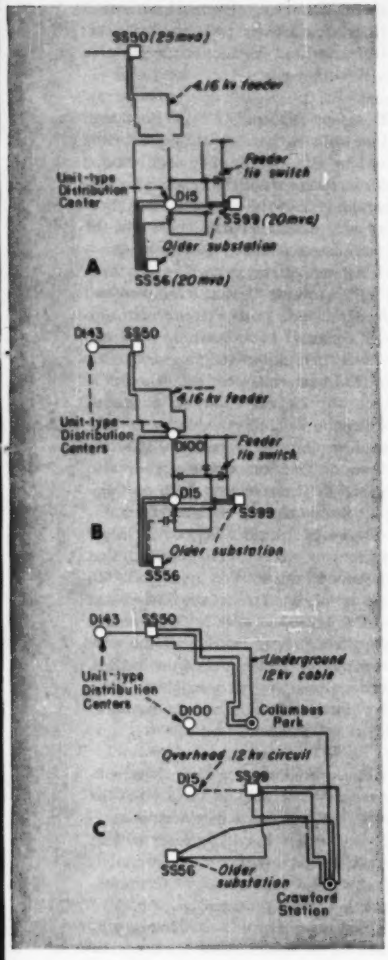
R. O. ASKEY, R. P. BURANDT, and H. D. ELY Engineers, Public Service Co of Northern Illinois

Development of a primary network system in an extensive suburban area west of Chicago has resulted in a high quality of service at very economical costs for distribution facilities. The primary network had a modest beginning with the installation of a single unit substation with its five feeders tied to two conventional substations. Growth was an evolutionary process of adding units at load centers to meet load requirements as they developed, and networking feeders to get maximum capacity from available equipment.

On the basis of experience with the primary network system, as devel oped, a number of conclusions have been reached.

1. Unit substations in 2,500- and 5,000-kva sizes operated in a network system with existing large and small 4.16-kv substation units have been found very economical.

2. Full reserve against loss of any unit or 4.16-kv feeder is attained with



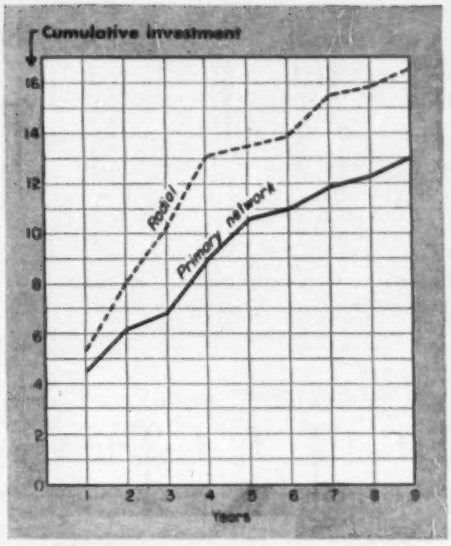


FIG 2—NETWORK REDUCES cumulative investment 15% to 21%, compared with conventional radial system.

Network

installed capacity only 10% greater than the load and without exceeding recognized thermal load limitations.

3. The time required for restoring service in case of a failure has been reduced.

4. Power loss in the system has been reduced and voltage problems in the area have been decreased.

5. Greater speed has been gained in making capacity installations.

6. The idea has proved to be good both economically and from an operating standpoint.

The benefits of networking have been realized, perhaps, because of conditions which are characteristic of the system and the territory.

Basis of Design . . . Development of this primary network was based on providing reserve transformer capacity with one subtransmission circuit or unit out of service. Subtransmission circuits are so interwoven that units surrounding any distribution unit that is out of service will pick up all the load of the affected unit. This design requires feeder circuits that are adequate to carry the loads under such emergencies. Service continuity is maintained after a fault on a subtransmission circuit or distribution center because of the provision for an alternate source of supply.

A fault on a trunk section of a primary network tie feeder may, because of high short circuit currents, burn clear. If this should happen, service is still maintained on all portions of the feeder because of the supply from both ends. On the other hand, a fault on this trunk section, if of persistent nature, could result in feeder lookout at both ends. Faults which occur on branches and laterals are isolated from the primary feeder by means of sectionalizing fuses. This is the same type of operation which would occur on a radial feeder. Experience on this system has shown that the major service continuity benefits from primary networking result from eliminating interruptions from outages of the subtransmission circuits.

Economies are realized because only a single subtransmission feed is needed for each distribution center, small increments of capacity can be added when and where they are needed instead of large radial substations, and costs are reduced by the use of standardized units. Associated with these advantages is flexibility to meet capacity requirements as the load grows.

Communities in the area covered by the network are essentially residential, with commercial load along main thoroughfares. Load density when the first network unit went into service in 1940, was about 2,500 kva per square mile. Today it has grown to 5,000 kva per square mile. Because of the concentration of commercial loads along the main thoroughfares, the primary network units were installed along these streets. Adjacent to Chicago, the 12-kv subtransmission circuits are predominantly of underground cable construction. In the territory several miles from Chicago, the 34.5-kv subtransmission circuits are

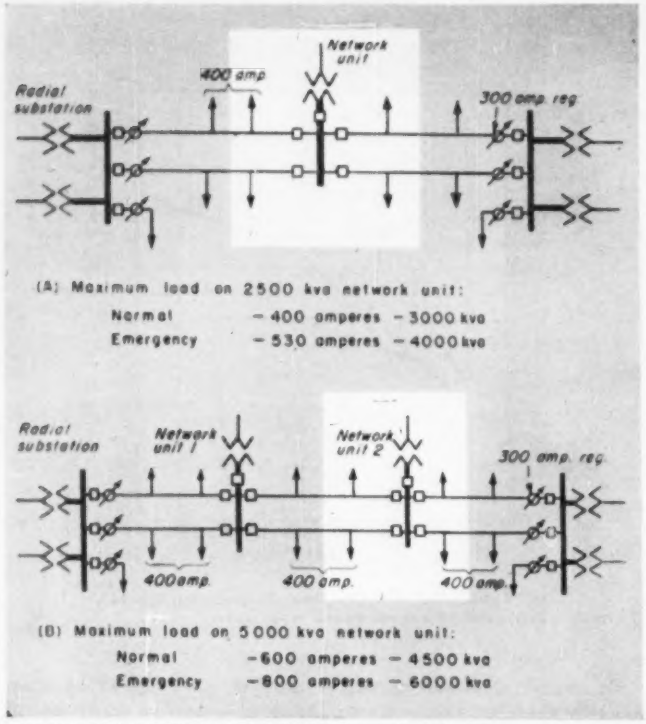

Radial substation
400 amp
Network unit
300 amp reg
(A) Maximum load on 2500 kva network unit:
Normal - 400 amperes - 3000 kva
Emergency - 530 amperes - 4000 kva
Radial substation
Network unit 1
Network unit 2
300 amp reg
400 amp
400 amp
400 amp
(B) Maximum load on 5000 kva network unit:
Normal - 600 amperes - 4500 kva
Emergency - 800 amperes - 6000 kva

FIG 3—(A) INITIAL 2500-KVA NETWORK UNIT normally feeds 100 amperes into each of four substation tie feeders. (B) Subsequent 5000-kva units feed 100 amperes into each substation feeder, more into network unit ties

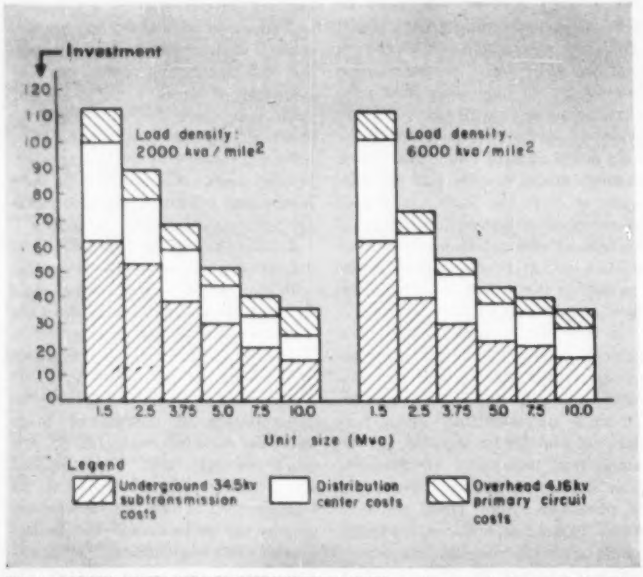


FIG 4—LARGER UNITS REDUCE DISTRIBUTION COST per kva at suburban load densities. Available transportation facilities generally limit size to 5000-kva maximum

largely overhead. Express portions of radial feeders are underground cable with overhead installations in the area served by each.

Develops Naturally . . . First unit type distribution center added to the system was a 2,500-kva unit. Radial feeders were readily accessible for networking, by the addition of short lengths of underground cable into the distribution center. Very little additional copper was needed in this area. Fig 1(A) shows existing substation and feeder layout, with the new distribution center D-15 represented by circle.

Network units were placed as close to load centers as possible. The initial unit was located adjacent to one of the commercial thoroughfares. As subsequent units were added, Fig. 1(B), these distribution centers were also placed at load centers along or adjacent to commercial thoroughfares.

It was not until 1948, when larger degrees of reserve were possible, that the second distribution center, D-100, was installed. A year later D-143 was added. These too were 2,500-kva units. To effect proper loading of the new distribution centers and of the feeders, feeder loads were reassigned. The flexibility involved in primary networking is apparent.

Subtransmission . . . The 12-kv subtransmission supply as it existed at the time the third unit was placed in service is shown in Fig 1(C). Firm sources are Crawford station and Columbus Park substation, both of the Commonwealth Edison system.

Here, two distribution centers supplied by subtransmission circuits from conventional substations are also networked on the 4-kv side with the same substations. They operate very successfully in this manner because multiple subtransmission circuits to the substations make the 12-kv buses relatively firm. The multiple subtransmission circuits were necessary for maintaining a reasonable degree of service continuity on radial distribution in the event that a subtransmission line outage occurs.

In contrast to this arrangement is the single-circuit subtransmission supply to each distribution center. Service continuity in this case is provided over the 4-kv feeder ties by reserve capacity in adjacent units when the subtransmission line is out of service. Essentially all of the circuits shown are 12-kv underground cables which pos-

sess reasonable degrees of service continuity during storm periods.

Grows Fast . . . Early experience led to scattered networks in various communities where load growth warranted. Networks mushroomed in such areas as LaGrange-Brookfield and in Elmwood Park with the expectation that they would eventually be tied together. Tying the existing networks together, as shown in Fig 1, was completed only recently. There are 38 distribution centers, six of which are conventional substations of 15,000 kva or larger. Of these 38 distribution centers, 25 are the package-type unit distribution center. Twenty of these unit are 2,500 kva and five are 5,000 kva.

Interim Networks . . . Fused 4-kv feeder ties, shown in the northwestern portion of Fig 1, make up what can be considered as a light capacity or interim type of network. The benefits of networking can be partially realized in these areas. The fuses serve to sever the network ties and form radial feeders during outages on the subtransmission circuits or in the distribution centers at times of exceptionally heavy load. This safeguards against potential damage to customers' utilization equipment from low voltage which would otherwise be experienced. These fuses also open during faults on the feeders.

The entire Wood Dale—Bensenville area is served by these fused ties. In the short time this arrangement has been in operation, a number of service outages have been prevented during lightning storms in light load periods. Several of the subtransmission circuits have gone out of service during these storms but service to customers has not been interrupted. In some cases the ties have also provided much-needed voltage improvement for the existing radial feeders.

A subtransmission line outage during heavy load periods would blow the fuses because sufficient reserve capacity has not been provided in adjacent units and circuits. But certainly the advantages achieved during the lighter load periods when a fault occurs, and during heavy load periods when no fault occurs, justified this type of network.

Network Saves Money . . . An economic study had determined that conversion to a primary network would be the most economical solution. Comparative costs of radial and network development of the area over a nine-year period are shown in Fig 2. Cost estimates were based on multiple circuit subtransmission lines to any radial unit which would have been added. These were reflected in the higher costs for the radial system.

Experiences with primary networking have developed certain design criteria and operating procedures for economic unit sizes, voltage regulation, and protection.

Optimum Unit Sizes . . . Determination of optimum distribution center sizes is based upon applications peculiar to the existing system and type of territory, hypothetical economic studies, and unit type distribution center sizes available from the manufacturers. For initial installations made in conjunction with existing radial substations, the 2,500-kva unit is considered the optimum size. Subsequent installations in parallel with other unit type substations should be 5,000 kva.

Establishment of the 2,500-kva initial size, Fig 3(A), is based upon the principle of increasing the load on 4.16-kv feeder ties from the nominal rating of 300 amp for radial circuits to 400 amp. This is, in effect, increasing the normal feeder loading to the emergency capacity of regulators and terminal equipment of the radial feeders being incorporated in the network.

FIG 5—TYPICAL RADIAL SUBSTATION which was relieved of load growth by networking feeders with unit-type distribution centers

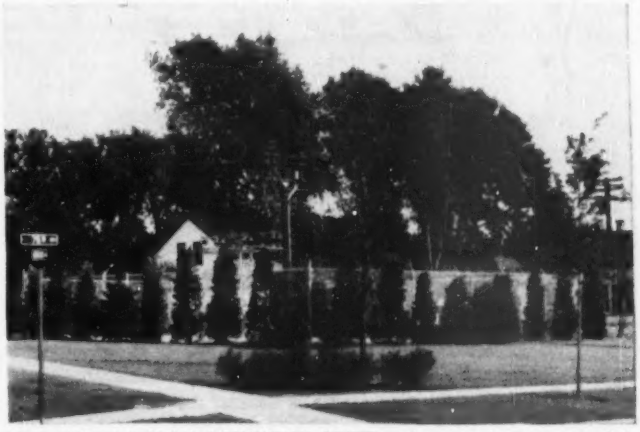


FIG 6—TYPICAL 2500-KVA DISTRIBUTION CENTER used to extend primary network in residential area. All electrical connections are underground and installation landscaped

Four feeders per distribution center is representative of the pattern in the area. The normal loading on the unit under the ideal conditions shown assumes adjustment of the compensators to approximate the ideal normal loading of 3,000 kva. Under emergency conditions, it will be approximately of 4,000 kva, as determined by load division studies.

Subsequent installation of a distribution center in parallel with other distribution centers is indicated in Fig 3(B). Normal loading on the distribution center in this case will be 4,500 kva and the emergency, 6,000 kva. For this reason the 5,000-kva size is used in view of its fan-cooled rating of 6,250 kva.

Economic substantiation of the 5,000-kva size has been derived on the basis of hypothetical studies for a 16-square mile area. Results of one such study are shown in Fig 4 in which the relative costs, as influenced by unit size, are compared. Weight restrictions of transportation facilities are an obstacle to the present use of sizes larger than 5,000 kva.

Overcurrent Protection . . . On this network, with several sources of supply and several 4-kv feeders from each station, current through the feeder breakers of a faulted tie feeder will be substantially greater than the current through other feeder breakers. For this reason all feeder relays have been set at substantially the same value with current settings on the transformer breaker relays only about 50% greater than on the feeder relays. If all of the radial taps from the feeder main were short, probably no additional sectionalizing devices would be used. However, many feeders have a number of long radial taps and these require sectionalizing devices. Protective systems available for network feeders preclude the use of the overlapping protection frequently used on radial circuits.

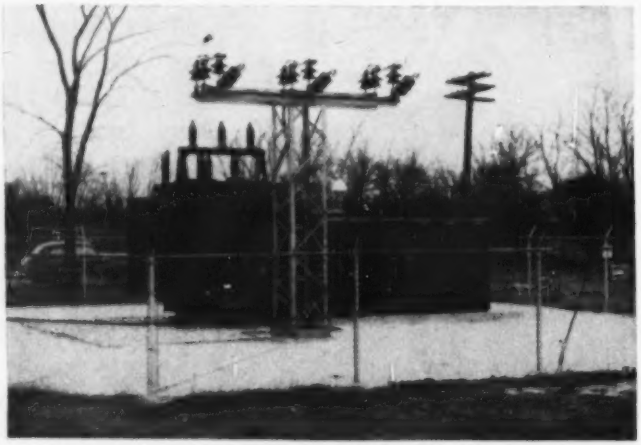


FIG 7—A 2500-KVA DISTRIBUTION CENTER in industrial area illustrates the type of equipment used. Landscaping is added to match adjacent property

FIG 8—"A" FRAME STRUCTURE OFFERS ECONOMY where space is available and surroundings permit use of open structures

Voltage Regulation . . . Paralleled feeders result in less supply system impedance. Voltage fluctuations from motor starting or welding loads are thus reduced. This is particularly helpful in the lighter load density areas.

By eliminating long radial feeders, the primary network avoids special voltage regulating devices on the feeder. If feeder ties are relatively short, it is usually necessary to have only bus regulation by load tap changers incorporated in the distribution center transformers.

Induction regulators are usually found on the feeders at the existing radial substations. When these feeders are incorporated into a network, it is necessary to use line-drop compensation to regulate the voltage at an established point on the feeders. This regulating point is usually just short of the load center on the feeder.

It is possible to obtain circulating currents in a primary network from relatively small random changes in voltage levels. These circulating currents, which are largely reactive, can produce unstable operation of regulators with normal line-drop compensation. In some installations the reactance compensation has been reduced and resistance compensation increased. In some cases a zero reactance setting with a large resistance setting has given stable operation for all load conditions. In a few cases it was necessary to adopt reverse reactance compensation. Unstable operation of regulators, however, has not been a critical problem in network operation.

Maximum Use of Investment . . . Immediate loading of distribution centers as they were installed, thus making maximum use of investment, was another feature of this development. Also, installations were made to blend with environment by suitable landscaping or fencing as determined by adjacent structures.

BOOK REVIEW

An analysis of methods for

Estimating Utility Plant Life

In modern depreciation accounting, estimates of plant life are a primary requisite. For the serious student EEI's new report compares techniques of estimating life of industrial property

P. H. JEYNES*, Public Service Electric & Gas Co, Newark, N. J.

Since 1946 the Edison Electric Institute has been studying the newest methods of analyzing retirement experience and forging from them a tool for estimating the future service life of utility plant.

The tool has now been completed. It is a book, "Methods of Estimating Utility Plant Life," and its authors are the members of the EEI Engineering Subcommittee of the Depreciation Accounting Committee.

In it the committee has not dealt with depreciation methods or recommended any particular method of accounting for the fact of depreciation. But it has clarified the depreciation concept by stressing two points:

1. Life estimates are not depreciation estimates.

2. Two separate and distinct steps are involved in developing life estimates.

a. The survey of past experience, relating to plant retired and gone.

b. The forecast of probable life of plant still in service. This is necessarily a matter for judgment. The actual life of existing plant is indeterminate until such future date as it is retired.

Analysis of Past Experience . . . Before analysis can be undertaken there must first be a statement of annual plant additions and retirements over a period of years, either in dollars or units of plant. Such a statement is sometimes obtainable from equipment history cards; or, in recent years from continuing property records. More often the only source of information lies in the books of account. In such case, careful scrutiny of the raw data is required, and extensive adjustments are ordinarily necessary. This important part of the estimating process is thoroughly discussed, and specific procedures are described.

Actuarial Analysis of Life . . . If actuarial analyses are to be made, it is necessary to establish the age of each retirement as well as each survivor, whether the study deals with dollars or with units of plant such as the number of transformers. This is exactly the same procedure used by life insurance companies to estimate human mortality. Two principal methods are recognized:

1. The original group method, and

2. The annual rate method.

The original group method obtains a composite survivorship characteristic by observing the ratio of survivors at each age to the original group of annual additions to which these survivors are related.

The annual rate method relates survivors of a given age to the survivors of the previous age-year, thus yielding a sequence of annual survival probabilities from which a survivorship characteristic can be constructed.

Turnover Analysis of Life . . . If the turnover methods or the simulated-plant-record methods are to be employed, a record of annual additions and retirements must be made available either in dollars or in units of plant. Four methods are described:

1. The Turnover-Period method
2. The Half-Cycle Ratio method
3. The Asymptotic method
4. The Geometric Mean method

Turnover-Period Method . . . This method has been used by the utilities for many years. It requires a tabulation of annual additions, retirements, and balances over a period of years approximating average life or more. Few accounts relating to long-lived plant have a sufficiently long history to qualify. Even fairly short-lived items provide a limited number of estimates, which means that trends in average life are not reflected fully or promptly.

Half-Cycle Ratio Method . . . This method was devised to overcome some of the frailties of the Turnover-Period Method, utilizing the same basic ideas. Although this method is more responsive to changes and trends it shares one weakness of other turnover methods in that great accuracy cannot be expected before completion of one complete life cycle (roughly twice average life).

Asymptotic Method . . . This method makes use of the fact that the ratio of retirements to plant balance in each year will approach a limiting value (its asymptote) with the passage of time, provides a fairly constant mortality pattern is experienced. Similarly, the ratio of additions to plant balance will approach a different limit, unless the plant is static. The geometric mean of the two ratios provides the index to average life.

Geometric Mean Method . . . The geometric mean method, sometimes referred to as a "simplified asymptotic" procedure, also utilizes the geometric mean of additions and retirement ratios as an index to average life. However, average values of these ratios are used, instead of their asymptotic values.

The Turnover-Period method is the least useful of the turnover methods because: First, it requires a record of additions and retirements over a period approximating average life (such a long history is often non-existent), and, second, it is not a particularly good indicator of trends in average life.

The Half-Cycle Ratio and Geomet-

(*Continued on page* 130)

* Author Jeynes was chairman of the Engineering Subcommittee, EEI Depreciation Accounting Committee when this report was published.

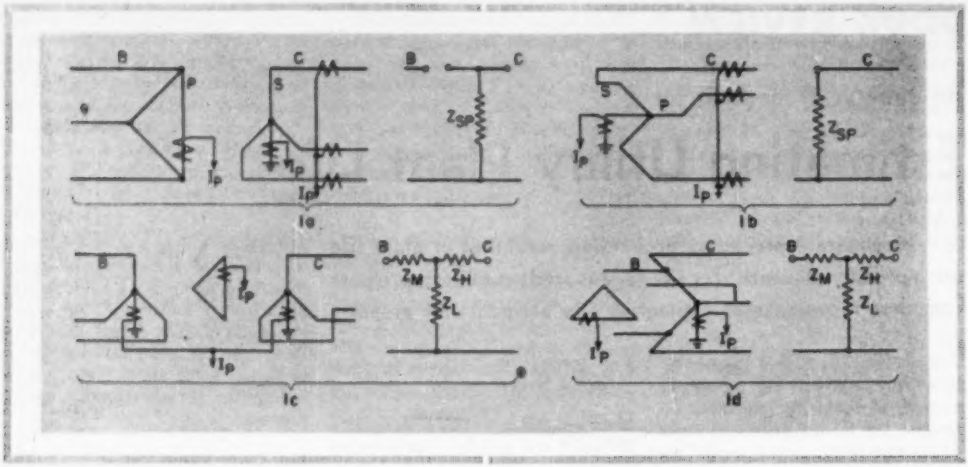


FIG 1—CURRENT TRANSFORMER CONNECTIONS with delta-wye transformer, and Z_0 equivalent circuit, equivalent diagram (a) shows transformer contributes ground current only to System C. CT in delta winding is not suitable for polarizing with generation on System B. CT connections with zig-zag grounding bank, and Z_0 equivalent circuit (b) show ground current supplied only to System C. With three winding wye-delta-wye bank CT connections are as in (c). Ground current is supplied to both Systems B and C as shown by Z_0 equivalent circuit. Removal of one ground puts this scheme of 1a with CT connections of (d) and three winding wye-delta-wye autotransformer. Ground current is supplied to both Systems B and C and shown by Z_0 equivalent circuit

Suitable Current Polarizing Sources For Ground Type Relays

Analysis by symmetrical components method illustrates satisfactory and unsatisfactory sources for directional ground relay application and shows how to determine suitable sources

OWEN A. LENTZ, Commonwealth Services, Inc, Jackson, Michigan

Reliable directional ground relaying depends on careful analysis of current-polarizing sources under system fault conditions. The accompanying diagrams show current-transformer connections for obtaining residual current. Studying these circuits and how they work under fault conditions will show the best arrangements for good relay operation at all times.

Transformer banks for current polarizing should act as a source of ground current to the system during a ground fault. The transformers of Fig 1 are of this type. Polarizing current supplied should be undirectional for the expected operating conditions. Grounded wye-wye transformers and comparable connections act only to transfer ground current between two systems in proportion to their turns ratio and cannot be used for polarizing.

Because the distribution of residual fault current in a system is governed entirely by the zero sequence impedance, analysis of the problem by the symmetrical components method can be confined to the flow of current in that network. Zero sequence current flow only is shown, but it refers also to residual current. The two terms are interchangeable because of the constant relationship of $I_n = 3\ I_0$.

Polarizing Current Sources . . . Fig 1 shows four common transformer connections, their equivalent zero sequence diagrams, and location of current transformers for obtaining polarizing current. The equivalent diagrams indicate that the transformers of 1a and 1b contribute ground current only to System C. Likewise, diagrams of Fig 1c and 1d indicate that they supply ground current to both Systems B and C. Removal of one of the grounds on Transformer 1c would place it in the 1a category. A system may be grounded by one or more of these transformer connections alone, or in various combinations, or by more complex connections. Complex connections usually break down into one of the basic categories of Fig 1 and they can be treated in much the same manner.

Transformers of Fig 1c and 1d provide interesting flow of residual current. It is their equivalent circuits which are chiefly responsible for this. Using transformer impedances on the "Circuit Basis" (HM, HL and ML) the equivalent circuits can be determined from the following relationships:

$$Z_H = \frac{Z_{HM} + Z_{HL} - Z_{ML}}{2}$$

$$Z_M = \frac{Z_{ML} + Z_{HM} - Z_{HL}}{2}$$

$$Z_L = \frac{Z_{HL} + Z_{ML} - Z_{HM}}{2}$$

Values of Z_H, Z_M, or Z_L may all be positive quantity, or any one of them may be negative when one impedance becomes greater in magnitude than the sum of the other two. The magnitude and location of this negative impedance in the equivalent circuit can have considerable effect on the flow of residual current.

The transformers of Fig 1a and 1b can be depended on for proper polarizing current for ground faults on the system to which the wye winding is connected. Their neutral current flow can reverse from normal under two conditions:

1. A ground fault or unbalanced loads on the adjacent system can induce a current flow in the neutral in either direction if other points on the system are grounded. This induced current may cause the system relay to operate; several remedial steps can be taken to overcome the difficulty.

2. The neutral current will also reverse when operating in systems with some types of three-winding banks and auto-transformers.

Satisfactory Polarizing Currents . . . Fig 2a shows the zero sequence network of two systems, B and C, interconnected by a three-winding transformer. The following analyses would also apply when the systems are interconnected by a wye-connected autotransformer with delta winding except for determining the magnitude of actual current flow in the autotransformer neutral.

In Fig 2b the flow of zero sequence current is shown for a fault on System C when all values of impedances in the zero sequence network are positive and have a finite value. Using the current flow of Fig 2b as normal, changes in zero sequence current flow can be seen for other conditions.

Starting with the impedance Z_L assume its magnitude is gradually reduced from a positive value down to zero. From Fig 2a it can be seen that when $Z_L = 0$ all the zero sequence current is supplied to System C by the delta of the three-winding bank, and the flow of current in System B becomes zero.

The next step is to assume Z_L takes on a finite value of negative impedance. Then the delta of the three-winding bank not only provides all the flow of zero sequence current to System C but, also generates an additional amount of current. This additional current is balanced by a flow in System B with a direction which is 180 deg from that in 2b.

Reversal in current flow on System B does not affect the direction of the polarizing current of the wye-delta-wye transformer, but the operating coils of the ground relay on System B at the wye-delta-wye transformer do see this change in direction. This results in the relays connected to protect for faults on System B toward the delta-wye transformer seeing apparent faults when the fault is actually on the C system. This point might easily be overlooked. Because the directional relays at the delta-wye transformer of System B experience a reversal in both operating and polarizing current, they see an apparent fault out on the line. The latter is not too serious as these relays normally see the fault on System C and must be properly coordinated. In each of the three preceding cases the polarizing currents of the three-winding banks have the same direction and would be suitable for polarizing directional relays.

Unsatisfactory Polarizing . . . Next consider Z_M of Fig 2a negative in value. If this negative value has a magnitude less than the positive value of $(Z_B + Z_{SP})$ the flow of current is the same as shown in Fig 2b and the negative value of Z_M is of no particular concern. When additional ground sources are connected to System B a check should be made to see that the relationship still holds.

When Z_M becomes negative and its magnitude equals the sum of $(Z_{SP} + Z_B)$, a path of zero impedance shunts Z_L. All the zero sequence current is supplied from System B, and the current in the delta winding becomes zero. Under this condition the three-winding bank acts like a two-winding transformer, and none of its current transformers would have any secondary current for polarizing, assuming the neutral current transformer ratios are inversely proportional to the H to M ratio. If the neutral current transformers are not in this ratio, a current will flow in the polarizing circuit but this current will reverse for faults on the high and low side of the transformer.

By gradually increasing the negative value of Z_M until it exceeds the sum of $(Z_{SP} + Z_B)$, Z_L is then shunted by a negative value of impedance. When this condition exists, System B supplies more zero sequence current than required by System C. This additional current is balanced by a return of current flow (Fig 2d) in the delta in a direction 180 deg to normal flow, thus showing that this transformer is unsuited for a polarizing source under the conditions given. It has generally been considered before that the delta

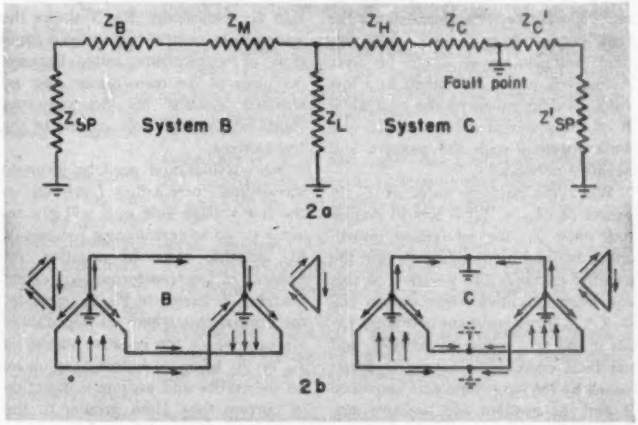


FIG 2—SATISFACTORY POLARIZING CURRENT SUPPLY depends on relative impedance values in the zero sequence network 1a of two systems, B and C, interconnected by a three-winding transformer. Zero sequence current flow in 2b occurs when all impedances in 2a are positive and have a finite value

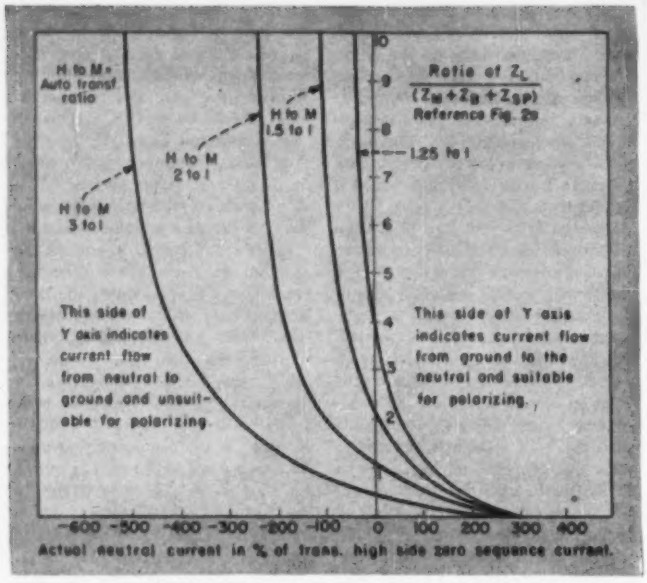

H to M Auto transf ratio
H to M 3 to 1
H to M 2 to 1
H to M 1.5 to 1
1.25 to 1
Ratio of Z_L / $(Z_M + Z_B + Z_{SP})$ Reference Fig. 2a
This side of Y axis indicates current flow from neutral to ground and unsuitable for polarizing.
This side of Y axis indicates current flow from ground to the neutral and suitable for polarizing.
-600 -500 -400 -300 -200 -100 0 100 200 300 400
Actual neutral current in % of trans. high side zero sequence current.

FIG 3—AUTO TRANSFORMER NEUTRAL CURRENT for ground fault on System C varies as function of transformer ratio, the impedances of the transformer and associated systems for line-to-ground faults on high side of transformer

current in a three-winding bank or autotransformer could not reverse and is a source of polarizing current that could be relied on under any and all conditions.

Special Cases . . . Continuing with Z_M negative, two special cases can be noted. One case is parallel resonance when the negative value of $(Z_{SP} + Z_B) - Z_M = Z_L$. Assuming inductance and capacitance with no resistance the fault current from the wye-delta-wye bank and System B would be zero. Actually it would be limited to a low value as determined by the equivalent R of the resonant zero sequence network together with the positive and negative networks.

When the negative value of Z_M in excess of $(Z_{SP} + Z_B)$ is less in magnitude than Z_L, the equivalent impedance obtained by paralling Z_L and the negative excess is also negative. If this equivalent negative value equals $(Z_B + Z_C)$, a series resonant condition exists in the zero sequence network; and the fault current magnitude is determined by the equivalent zero sequence R and the positive and negative networks values of impedances.

It has been shown that negative value of reactance in transformer equivalent circuits can cause unusual current flow and may cause incorrect relay operations. The condition giving these abnormal cases occurs rather infrequently but should not be overlooked when they do occur.

A condition more frequently encountered is the necessity of determining whether a current transformer in the neutral of autotransformers (Fig 1d) will supply a current of sufficient magnitude and proper direction for polarizing. Fig 3 shows the variation in neutral current as a function of transformer ratio, the impedances of the transformer, and associated systems for line-to-ground faults on the high voltage side of the transformer.

No consideration need be given to the neutral current flow for faults on the low voltage side as it will not reverse or go to zero except for one of the extreme cases of negative impedance in the transformer equivalent circuits. Referring to Fig 2a, consider the normal case where all impedances are positive or the negative values of Z_M or Z_B being such that they cause no difficulties and assume a direction of current flow from ground to the neutral for faults on System B, the low voltage side. With this current as reference, faults on the high voltage System C, may cause the neutral current to flow in the same direction, zero in magnitude or 180 degrees out of phase.

Determine Suitable Sources . . . Curves of Fig 3 have been plotted with the neutral current expressed in percent of the high side zero sequence current from the transformer to the fault. For each fault location on System C, or change in generation, the magnitude of the zero sequence current changes. However, the magnitude of the current which is also a function of the positive and negative sequence impedances is not required to determine the direction of current flow. For a given autotransformer ratio the actual direction of current flow in the neutral is determined by the ratio of

$$\frac{Z_L}{Z_M + Z_B + Z_{SP}}$$

in the zero sequence network. This ratio has been plotted against the per cent neutral current with the autotransformer ratio as the parameter.

Neutral currents on the curves to the right of the Y axis indicate that the neutral current direction is the same for faults on both sides of the transformer and thus is suitable for a polarizing source. Currents on the curves to the left of the Y axis indicate that the neutral current is 180 deg to that for faults on the low voltage side and is unsuitable for polarizing. Points falling close to the Y axis show that the magnitude of the neutral current is small, and any changes in system grounding may cause the current to reverse direction. The limiting condition for a given transformer ratio is the minimum magnitude of $(Z_M + Z_B + Z_{SP})$ in the ratio of

$$\frac{Z_L}{Z_M + Z_B + Z_{SP}}$$

If the current falls to the right of the Y axis for this minimum value, the neutral will supply a suitable polarizing current.

Often the use of voltage for polarizing is the desirable method. However, it has its limitations. The cost of providing potential may be out of proportion as compared to the use of one or two low voltage current transformers in power bank neutrals. In many cases it will not provide reliable relay operation because of low residual voltage at points where the system is grounded by one or a number of large power transformers.

WASHINGTON COMMENT

JESSE MOCK

New Year celebrations in Washington will be minor ones. In the nation's capital the one big celebration of 1953 will take place on Jan. 20. For the incoming Republicans that will be New Year's Day as well as Inauguration Day. And no expense is being spared to mark the event.

A New Federal Power Policy—When and What?

One can hardly blame a political party that has been out of office for nearly 20 years for celebrating. But celebrations are often followed by headaches, and this one will be no exception. After the tumult and the shouting have died, President Eisenhower and his Cabinet will begin the difficult conversion from a Democratic to a Republican administration. While many industry men are elated at the prospect, it will take a lot of patience if the Republicans are to get the best possible start.

Most routine functions of government will continue with little disruption. Where policy decisions are to be made, progress will be slower. This is particularly true in the electric power field.

Much to Do in the Electric Power Field . . . Several proposed power transmission contracts between the the government and electric utility companies now wait on the desk of the Interior Secretary. If the incoming Secretary finds them when he takes office, the new administration may want to start from scratch in renegotiating them. Departure from present policy in handling these contracts may require long and tedious study.

The further development of multipurpose hydro projects is a similar situation. A full program of construction has already been planned by the Truman administration and is included in the budget which is to be submitted to Congress in early January. Eisenhower and his advisors may want to review these plans before endorsing or rejecting them. Here again patience and understanding are required on the part of interested parties.

Republicans Have a Big Job to Do . . . For nearly 20 years the Democrats have been building their policies and programs. Until Nov. 4 these appeared to have a wide political appeal. To a great extent the Republicans won the election without offering a specific alternative program. The specifics are still to be worked out.

New Cabinet members will have to gather their staffs and familiarize themselves with their jobs. Many of these men have had no experience in their tasks or even in any government job. Many are experienced businessmen. But many other men equally experienced who have come to Washington in the past decade will testify that there is enough red tape in government operations to hamstring the wisest man.

Waiting but Waiting for What . . . All this means that for the power industry there will be a long wait ahead before much or any change is made in government power policy. Because power policy was not one of the important campaign issues there will be a tendency to take up first the issues that were. The Democrats are satisfied to go along with the present policies they have established. Any changes in these policies will have to be forced by the Republicans.

What is more when the Republicans do get around to changing power policy, it is not unlikely that the party will find itself split. With the slim majority the administration has in both houses, it won't take much of a split to ground any high flying plans of proponents of a new power policy.

So it might be smart for opponents of the Roosevelt-Truman power program not to get too jubilant on Jan. 20. So far the Republicans have not spelled out the details of their new federal power policy. And no one knows what is going to happen to that policy when Congress gets its hands on it. Until then it is just going to be a long period of waiting for the power industry. And the time will only seem the longer because no one really knows for what the industry is waiting.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Silicone rubber appears not to suffer in dielectric strength with age. It may provide the means of achieving prevailing impulse strengths of oil-type units in dry-type transformers.

Faults involving both circuits of a double line are infrequent but how frequent is not well statisticated.

Extractions began with one and have crept up to as high as 8 or even 10. Single reheat is the present vogue. Will second and third reheat some day likewise prove in?

Algae are practically always present in cooling water with 60% of the cases rated moderate to severe and requiring chlorination for control.

Transformer noise probably is not due for an early and easy solution. Economic gain from high core density is too significant to pare without a search in other directions.

Argon present in the air used to cool an atomic pile becomes radioactive but only to double the degree normally existing because of cosmic rays, radium, thorium, etc. It halves every two hours if unsustained.

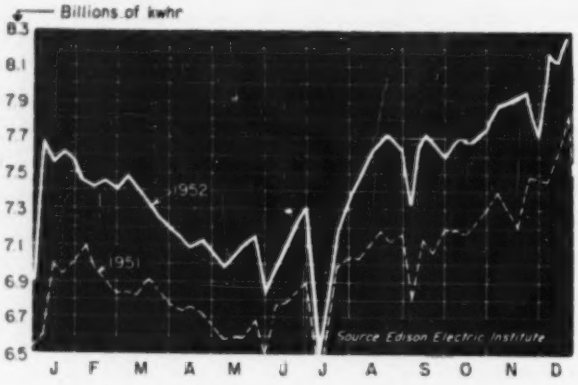
Boiler life is longer and day-to-day operation smoother if the controls are capable of maintaining the heat input in step with the heat output to the turbine.

Shaft generators for auxiliaries are relatively free of disturbances affecting the main unit. Some designers therefore prefer this source to tapping generator leads or bus.

Crossed-over leads in a three-phase transformer have a line-to-line voltage difference; in banks of single-phase the difference is only line-to-neutral.

Steam superheat and reheat 1200F is within sight as a commercial practicability now that alloys have been subjected to such operation for upwards of 1500 hours in a 2000 psig boiler. Economic replacement may compensate for probable short service life of the tubes.

STATISTICS



Output Week Ended Dec. 20—8,140,257,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	East Cent.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Dec. 20	+5.8	+6.8	+3.0	+7.2	+6.2	+9.9	+3.9	+5.7	−7.7	+10.5
Dec. 13	+6.2	+9.9	+5.5	+7.8	+8.1	+8.7	+4.8	+4.6	−9.0	+7.7
Dec. 6	+9.7	+14.7	+7.7	+11.7	+9.4	+13.6	+8.6	+9.3	−4.3	+9.3

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Sept.	69.7*	69.7	64.7
Capacity (Million Kw)	Oct.	79.70	78.78	74.68
Production (Billion Kwhr)	Oct.	34.82	33.38	32.44
Hydro		7.04	7.36	7.55
Fuel		27.80	26.02	24.89
Fuel Consumption				
Coal (Million Tons)	Oct.	9.92	8.82	9.59
Oil (Million Barrels)		7.16	6.03	5.46
Gas (Billion Cu Ft)		83.08	97.37	71.74
Sales (Billion Kwhr)	Oct.	30.15	30.11	27.68
Residential		7.72	7.66	6.85
Commercial		5.09	5.37	4.65
Industrial		15.16	14.75	14.13
Other		2.17	2.33	2.05
Net Income Class A & B Companies ($ Million)	Oct.	53.67	73.12	65.47
Estimated Dec. 52 Peak (Million Kw)	Sept.	79.7	80.0	80.3
Kwhr per Residential Customer (12 Month Average)	Sept.	2,131	2,119	1,961
Revenue per Kwhr Residential Service (12 Month Average)	Sept.	2.77¢	2.77¢	2.83¢
Canadian Production (Billion Kwhr)	Sept.	4.99	4.97	4.41

Business Statistics

FRB Industrial Production Index †††	Nov.	230	231	220
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	343.4	342.6	337.1
E. W. S Industry Production Index	Nov.	128.3	127.4	122.1
ENR Construction Cost Index ††	Nov.	121.1	120.7	114.7
BLS Consumer's Price Index	Oct.	190.9	190.8	187.4
NEMA Insulation Materials Sales Index †	Oct.	559	531	559
NEMA Electric Appliance Sales Index †	Oct.	260	231	305
NEMA Household Refrig. Sales Index †	Oct.	122	136	113
Metal Prices, (Dec. 3)				
Copper, Conn. V., lb.		$.24½	$ .24½	$ .24½
Lead, N. Y., lb.		.14¼	.14	.19
Zinc, prime Western E. St. Louis, lb.		.12½	.12½	.19½
Tin, Straits, qual. N. Y. lb.		1.21½	1.21⅜	1.03
Aluminum, ingot, base price		.20	.20	.19
Nickel, base price		.56½	.56½	.56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Estimated. † 1936=100 †† 1949=100 ††† 1937-39=100 (Unadjusted)

Capital Expenditures By Electric Utilities

A new series including capital expenditures by electric utilities has been jointly published by the Securities and Exchange Commission and the Office of Business Economics.

The SEC series on electric utility outlays differs from the series published in Electrical World primarily in that SEC's is confined to private companies. In addition this series includes outlays for gas facilities by mixed electric and gas companies.

Electric Utility Expenditures for New Plant & Equipment

	$ Million
1939	450
1945	368
1946	532
1947	1,029
1948	1,903
1949	2,183
1950	2,097
1951	2,180

The series is based entirely on company expenditure data reported to the SEC in mandatory annual reports of all corporations registered with it. Data received from this group are adjusted to universe on the basis of gross capital assets of corporations as reported to the Bureau of Internal Revenue for 1948.

Expenditures for New Plant & Equipment (Millions of Dollars)

	1952		
	I	II	III
Manufacturing	2,742	3,251	3,087
Mining	208	238	245
Railroads	362	391	375
Transportation, other than rail	261	417	343
Public Utilities	847	1,055	1,171
Commercial and other	1,708	1,752	1,649
All Industries	6,228	7,104	6,870

Expenditures for New Plant & Equipment (Millions of Dollars)

	1939	1950	1951
Manufacturing	1,943	7,491	11,130
Mining	326	707	911
Railroads	280	1,111	1,474
Transportation, other than rail	365	1,212	1,492
Public Utilities	520	3,309	3,855
Commercial and other	2,078	6,775	7,470
All Industries	5,512	20,605	26,332

For 1948, capital additions by corporations reporting to the SEC were stepped up by the ratio of industry-wide, gross capital assets to the gross capital assets of the companies reporting to the SEC.

The 1948 industry-wide estimates were then carried backward and forward on the basis of the sample of registered companies.

SMUD Signs for CVP Power

Sacramento municipal system will get 290,000 kw starting July 1, 1954. Contract replaces one city has with PG&E

A 40-year power contract was signed in Sacramento, Calif., Dec. 11 by the Sacramento Municipal Utility District's board of directors and Richard L. Boke, representing the Bureau of Reclamation.

The contract, effective July 1, 1954, replaces one now in effect between SMUD and the Pacific Gas & Electric Co.

Contract No. 18 . . . The contract, providing for a maximum of 290,000 kw, was the 18th signed by the bureau for delivery of Central Valley Project power to public agencies. In each case except one, PG&E has agreed to wheel the power for 1 mill per kwhr of energy delivered, plus 5% for transmission losses. The payoff is in power fed into the company's system. The exception is the Port Chicago Naval Magazine, which receives power directly from a CVP transmission line in Contra Costa County.

Actually 350,285 kw of CVP power have been contracted for to date, the bureau admits, although the present CVP firm output from Shasta and Keswick plants is roughly only 300,000 kw (EW, Sept. 15, p 21).

More Firm Power . . . When the Folsom and Nimbus plants on the American River are put on the line in late 1954, another 100,000 kw of firm power will be available.

The bureau has also pledged to deliver 33,000 kw to the Colorado River Commission of Nevada by next June 30, provided the commission can make arrangements for its delivery from the CVP load center near Tracy, Calif.

The bureau says, however, it must be realized the present needs of SMUD are 140,000 kw and the 290,000 kw maximum will not be reached until 1959 or 1960 and by that time Folsom and Nimbus and possibly additional CVP power plants will be working.

James E. McCaffrey, SMUD general manager and chief engineer, pointed out contract negotiations with the bureau as well as PG&E have been in progress since early in 1952.

"The PG&E offer proposed a continuation of essentially the present contract for a term of ten years at the power rate now in effect for the district," McCaffrey informed the board. "In addition, such a PG&E contract would have been subject to approval by California Public Utilities Commission.

Lower Power Rate . . . "The bureau offer, by contrast, was for a term of 40 years at a power rate 17% lower.

"Based upon a thorough consideration of the provisions contained in both offers, it was our recommendation that the bureau's offer be accepted.

"The new SMUD-bureau contract will run for 40 years beginning with the date power is first supplied. Present plans call for power to be wheeled over PG&E facilities beginning July 1, 1954," McCaffrey said.

Five Year Adjustments . . . "After that time it may be adjusted at five year intervals in accordance with charges in costs experienced by the CVP, subject to certain conditions. The effect of this lower power rate will not be felt until the expiration of the present contract with the PG&E."

PSC Grants Jamestown 2-Year Trial Rate Hike

City of Jamestown, N. Y., has received Public Service Commission approval to increase rates by $321,500 a year for a two-year trial period beginning Jan. 1.

This increase, the commission reported, will restore the municipality's electric system to "a sound financial basis."

In approving this temporary increase, the commission said:

"This commission would be remiss in the performance of its obligation to the public if it neglected to impress on all concerned a consciousness of the troublesome problems which confront municipally owned electric generating facilities in these days of unprecedented demand for electric energy. In the instant case, it appears, to date, that all the benefits which flow from either partial or complete tax exemption have been dissipated and the residents of Jamestown must pay higher rates in all classifications than the neighboring customers of a privately owned utility which bears its allotted share of the burden of supporting government."

Merger Urged

WWP sends letters to Puget stockholders recommending the combination of the 2 utilities

Stockholders of the Puget Sound Power & Light Co have received a letter from Kinsey M. Robinson, president of the Washington Water Power Co, which urges merging of the two companies.

The merger proposal, unanimously approved by the WWP board of directors, previously had been made to Frank McLaughlin, president, and directors of Puget Power. Only reaction has been a suit by McLaughlin against WWP, seeking an injunction to restrain company officials from interfering with proposed sale of Puget Power to a group of PUD's. First hearing in this suit is scheduled for Dec. 30 at Wenatchee, Wash.

WWP Proposal . . . The Robinson proposal offers to exchange shares of WWP stock with shares of Puget Power on a share for share basis, or one share of WWP common and $27.50 in cash for each two shares of Puget Power common.

Robinson cites the following advantages for the merger:

1. Shareholders in each company would retain an interest in a larger and stronger company with prospects of increased dividends and greater value of their stock.

2. Through merger of the properties there would exist a unified and stronger operation with resulting economies.

3. The stronger merged company would be able to proceed with the construction of additional power plant facilities, thus providing additional and adequate generating capacity in an area where there is a continuing and growing need for electric power and where there have been power shortages.

Today in Utility Finance

YIELDS (%)

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE									
1952									
Dec. 18	2.97	3.01	3.13	4.05	4.20	4.58	5.00	5.34	5.62
Dec. 11	2.96	3.00	3.11	4.05	4.21	4.54	5.00	5.34	5.67
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.50	5.96
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47
4th 1951	3.02	3.07	3.21	4.22	4.50	4.91	5.42	6.18	6.84

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months	Period Ended	Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Central Illinois Light	12	Nov.	$2,909,121	$3,068,772	$2.68(a)	$2.85(a)
Central Maine Power	12	Nov.	4,627,775	4,350,082	....	....
Central Vermont Public Service	12	Nov.	1,009,306	831,930	....	....
Minnesota Power & Light	12	Nov.	3,372,108	3,231,588	3.25	3.09
Ohio Edison, consolidated	12	Nov.	15,820,326	13,969,006	2.91(b)	2.62(b)
Southwestern Public Service	12	Oct.	5,692,929	4,790,806	1.50(a)	1.35(a)

Notes—(a) Based on 900,000 shares outstanding at end of each period; (b) Based on 4,798,460 shares in 1952 and 4,616,701 shares in 1951; and (c) Based on 3,521,549 shares in 1952 and 3,270,035 shares in 1951.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF DECEMBER 18-24			
Debentures			
Consolidated Gas, Electric Light & Power—conv. 3¼% 1967 (being offered to commonholders on basis of $100 debenture for each 30 shares of common, record Dec. 1 to expire Dec. 18)	$16,484	$100.00	3.25%
Common Stock			
Cleveland Electric Illuminating—557,895 sh (being offered commonholders on 1-for-5 basis, record Nov. 24 to expire Dec. 19)	$24,129	$43.25	0.10%
WEEK OF DECEMBER 25-31			
None			
SCHEDULE FOR JANUARY			Bid Date
Bonds			
Salt River Project Agricultural & Improvement District, Ariz.—improvement bonds due 1960-1982	$5,000	.....	Jan. 7
Kansas City Power & Light—1st mtg	12,000	.....	Jan. 20
Ohio Power—1st mtg	22,000	.....	Jan. 20
Iowa-Illinois Gas & Electric—1st mtg	8,000	.....	Jan. 27
Jacksonville, Fla., electric system	18,000	.....	Feb. 3
Preferred Stock			
Ohio Edison—150,000 sh $100 par	$15,000	.....	Jan. 13
Ohio Power—100,000 sh $100 par	10,000	.....	Jan. 20
Iowa-Illinois Gas & Electric—60,000 sh $100 par	6,000	.....	Jan. 27
Common Stock			
Southern California Edison—500,000 sh	.....	.....	Jan. 14
Toledo Edison—600,000 sh	.....	.....	Jan. 13
Ohio Edison—479,846 sh (to be offered to commonholders on 1-for-10 basis, record Jan. 8 to expire Jan. 23; stockholders to be allowed oversubscription privileges; company will name subscription price)	.....	.....	Jan. 7#
Consumers Power—617,669 sh (to be offered commonholders on 1-for-10 basis, record Jan. 15 to expire Jan. 30; company will name the subscription price)	.....	.....	Jan. 14#
Southwestern Public Service—about 293,500 sh (to be offered to commonholders on 1-for-12 basis; stockholders will be allowed oversubscription privileges)	.....	.....	.....
West Penn Electric—264,000 sh (to be offered commonholders on 1-for-15 basis, record about Jan. 23 to expire about Feb. 9; company will name subscription price)	.....	.....	Jan. 10#
UNSCHEDULED AND UNDER CONSIDERATION			
Bonds			
Central Maine Power—1st general mtg	$6,000	.....	.....
Toledo Edison—1st mtg	7,500	.....	.....
Rockland Light & Power—1st mtg	5,500	.....	.....
Southwestern Public Service—1st mtg	12,000	.....	.....
Wisconsin Public Service—1st mtg	7,500*	.....	.....
Monongahela Power—1st mtg	10,000	.....	.....
Debentures			
Washington Water Power	14,000*	.....	.....
Preferred Stock			
Rockland Light & Power	5,500	.....	.....
Southwestern Public Service	2,000	.....	.....
Wisconsin Public Service	2,500*	.....	.....
Common Stock			
Central Maine Power	$5,000	.....	.....

Notes—* Estimated. # Date of competitive bids of purchase of any unsubscribed shares.

CALENDAR

*** Edison Electric Institute**
Accident Prevention Committee, Hotel Muehlebach, Kansas City, Mo., Jan. 12-13, 1953; Prime Movers Committee, Mayflower Hotel, Akron, Ohio, Feb. 2-3, 1953; Transmission-Distribution Committee, Shoreham Hotel, Washington, D. C., Feb. 12-13, 1953; Electrical Equipment Committee, Jefferson Hotel, St. Louis, Mo., Feb. 16-17, 1953; 19th Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 30-April 2, 1953.

Institute of Radio Engineers
Joint High Frequency Measurements Conference with AIEE, Statler Hotel, Washington, D. C., Jan. 14-16, 1953.

Canadian Electrical Association
Eastern Zone: Engineering Division, Nova Scotian Hotel, Halifax, N. S., Jan. 15-16, 1953; Sales Division, General Brock Hotel, Niagara Falls, Ont., Jan. 22-23, 1953; General Division, Mont Tremblant Lodge, Mont Tremblant, Que., Jan. 29-30, 1953; Following Western Zone Division Meetings will be held at Palliser Hotel, Calgary, Alta.; Engineering, Feb. 23-25; General Division, Feb. 25-26; Sales Division, Feb. 26-27, 1953.

American Institute of Electrical Engineers
Winter General Meeting, Hotel Statler, New York, Jan. 19-23, 1953.

National Rural Electric Cooperative Association
11th Annual Meeting, Civic Auditorium, San Francisco, Jan. 26-29, 1953.

*** Public Utilities Advertising Association**
Region 8 Meeting, Mayo Hotel, Tulsa, Okla., Feb. 2-3, 1953.

National Association of Corrosion Engineers
Short Course in Corrosion in cooperation with University of California, Berkeley, Feb. 2-6, 1953.

Missouri Valley Electric Association
Industrial-Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 5-6, 1953.

*** Pennsylvania Electric Association**
Joint Meeting of Electrical Equipment-Relay Committees, Roosevelt Hotel, Pittsburgh, Feb. 5-6; Hydraulic Power Committee, Hotel Roosevelt, Pittsburgh, Feb. 5-6, 1953; Transmission-Distribution Committee, William Penn Hotel, Pittsburgh, Feb. 12-13; Systems Operation Committee, Hotel Brunswick, Lancaster, Pa., Feb. 19-20, 1953.

*** Maryland Utilities Association**
Annual Meeting, Lord Baltimore Hotel, Baltimore, Feb. 17, 1953.

National Adequate Wiring Conference
La Salle Hotel, Chicago, Feb. 26-27, 1953.

*** Southern Safety Conference-Exposition**
Hotel Atlanta Biltmore, Atlanta, Ga., March 1-3, 1953.

*** North Central Electric Association**
Electrical Industries Meet, Hotel Nicollet, Minneapolis, March 8-11, 1953.

*** National Electrical Manufacturers Association**
Winter Meeting, Edgewater Beach Hotel, Chicago, March 9-12, 1953.

*** North Central Electrical Industries**
1953 Electrical Industry Convention, Hotel Nicollett, Minneapolis, March 8-11, 1953.

*** Illuminating Engineering Society**
Canadian Regional Conference, Chateau Laurier, Ottawa, Ont., March 23-24, 1953.

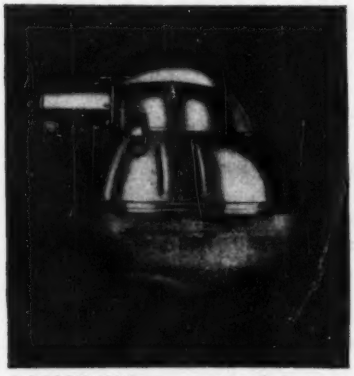
*** Southeastern Electric Exchange**
20th Annual Conference, Boca Ration Hotel, Boca Ration, Fla., March 23-24, 1953.

*** A&M College of Texas**
Conference for Protective Relay Engineers, Dept. of Electrical Engineering, College Station, Tex., March 23-25, 1953.

* Addition this week.

BOTH HIGH-SPEED SAFETY AND LOW MAINTENANCE COST MADE POSSIBLE WITH G-E FORM 109 LUMINAIRES.

Safe speed with G-E Form 109's on two New Jersey Turnpike bridges



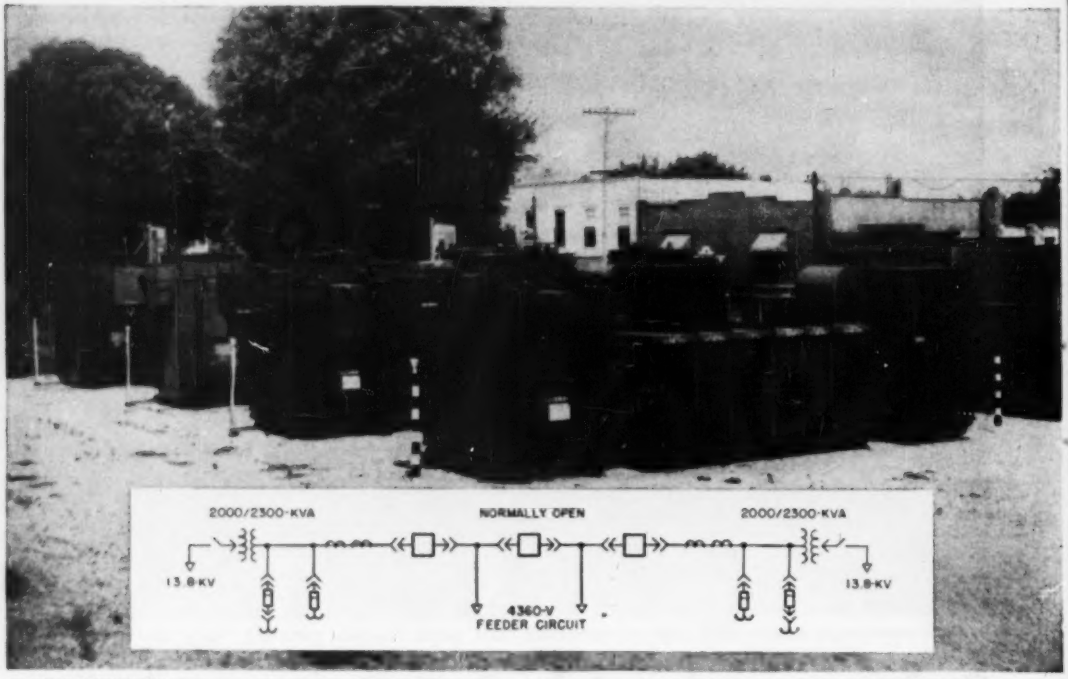
G-E FORM 109 features rectangular pattern, uses mercury or filament, gives economical mercury-lamp operation with magnetic coil.

NO NIGHT FATALITY has occurred on the two New Jersey Turnpike bridges illuminated by G-E Form 109 Luminaires, despite heavy traffic averaging 84,000 vehicles during every 24-hour period. The Form 109's make safe, high-speed driving possible where the New Jersey Turnpike bridges the Hackensack and Passaic Rivers, and warn motorists of the change from the usual straight-away travel.

USE FILAMENT LAMPS. Average intensity of 0.6 footcandles on the concrete roadway is provided by 133 G-E Form 109's equipped with 10,000-lumen, 20-ampere filament lamps, at a mounting height of 30 feet to light center, with 100-foot staggered spacing. Poles are isolated from the road area with a special bracket mount which mounts them over the side of the bridge structure.

LOW MAINTENANCE. The G-E Form 109 luminaire gives you the flexibility of using either mercury or filament lamps, the economy of G-E standardization, and extremely high light utilization. You are assured of minimum maintenance cost with quick, easy relamping and low glassware breakage. For information, ask your G-E representative for Bulletin GEA-5419. Or write Section 452-135, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC



"BLOCK BUILDING" in Kansas City. Substation 45 points up "building block" method. Two G-E 4000/4600-kva master unit substations were installed in 1947, two more in 1949. One-line diagram (inset) shows type of standardized duplex station used.

Missouri utility plans ahead for expansion using standardized G-E unit substations

Kansas City Power & Light gains system flexibility with "building block" approach

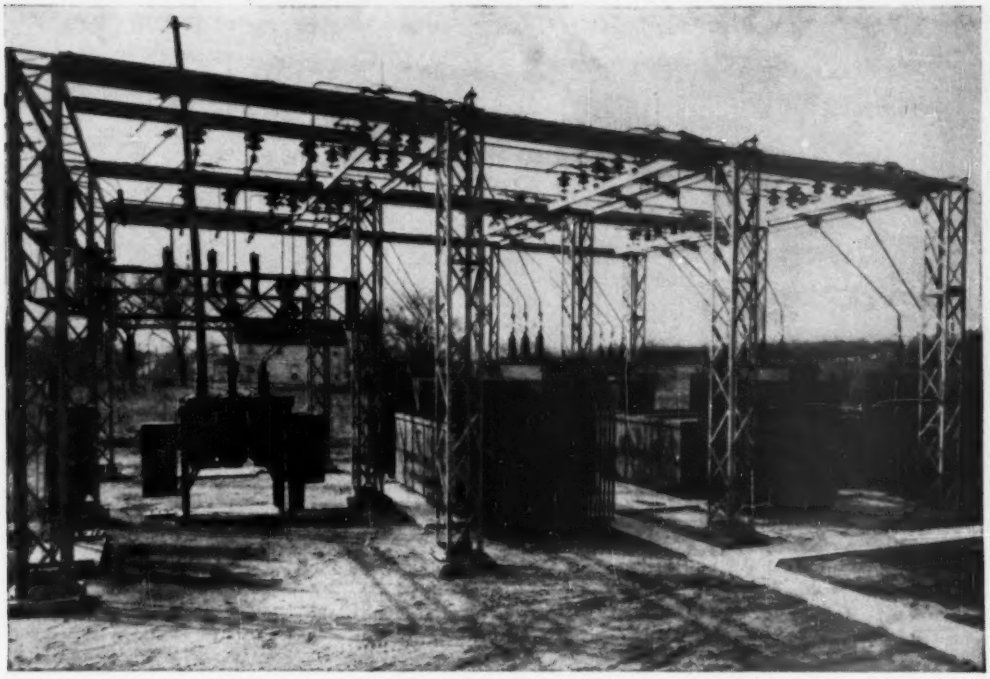
With 22 G-E standardized master unit substations installed over a five-year period, Kansas City Power & Light Co., Kansas City, Mo., knows the value of advanced planning—using duplicate units as "building blocks" in its system.

This "building block" method—which permits adding or removing capacity in easily handled, relatively small "blocks of power"—has enabled the Missouri utility to expand its system simply and economically. Engineers early decided upon the unit substation which best suited their purposes—in this instance, a G-E 4600-kva duplex unit.

In addition, utility engineers have achieved maximum flexibility to take care of unexpected load growth. They can meet load shifts simply by shifting the standardized G-E units. If the load should change radically, they can move quickly to other types of standardized G-E unit substations, still employing the "building block" approach.

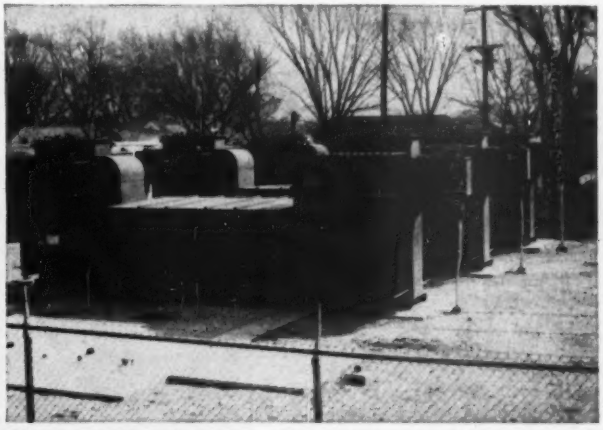
Your needs most likely parallel those of the Kansas City utility, and you, too, will find that advanced planning with the "building block" method keeps system investment as low as possible in relation to actual load. Small "blocks of power," with their flexibility and economy, give insurance against excessive investment in unused capacity.

At the same time, G-E factory-assembled master unit substations simplify planning and purchasing—save time in delivery and installation. And with G-E equipment, you are assured of dependable, first-quality components made possible by repetitive manufacturing methods. For full information, write for Bulletin GEA-4500. *General Electric Company, Schenectady 5, New York.* 323-100



STANDARDIZED SUBSTATION. Supplied complete by General Electric, 3 units and steel structure of Substation 30 were delivered ready for immediate installation. Factory-engineered substations simplify purchasing, save valuable engineering time.

CONCEALED BY TREES. This one-unit substation in residential area shows how proper planting can effectively camouflage installations.



READY FOR NEXT UNIT. Kansas City's Substation 84 has three duplex units already installed. Foundation, in foreground, is set for fourth unit, if required for increased load.

GENERAL ELECTRIC

2,000,000 GALLONS of burning fuel oil is extinguished by air alone

FASTEST OUT was less than fifty seconds, in three separate ignitions

Air Agitation Stops Fuel Oil Fire

Results of Socony Vacuum's two years tests demonstrated recently that the burning of low viscosity high flash point fuel can be stopped quickly by injecting air into the tank. The air brings cooler oil to the top, reducing the vapor concentration below combustion conditions, and the fire dies, starved out. The air can be injected through existing tank pipes, preferably one terminating near the tank's center so air spreads quickly to tank edge.

With high viscosity crude oil, air agitation reduces the burning to a degree easily extinguished by foam or water means. Although agitation alone does not extinguish the flame, as it did with kerosene, it does prevent "slop-over," the increased flame actually resulting from heat waves created when foam or water alone are used. Greater viscosity and tank depth mean more difficult control.

Fire control during high winds is slower, since spread of coal oil is not quick and even in all directions. But agitation method still brings the fire to heel in a matter of minutes.

Removable Hoisting Reel Saves Time and Labor

D. G. FRITZ, The Ohio Power Co., Lima, Ohio

A removable rope reel used on the end of a truck winch shaft has saved labor and time on operations such as installation, repositioning or removal of distribution line transformers, loading poles from piles on to trailers, and temporary pulling requirements.

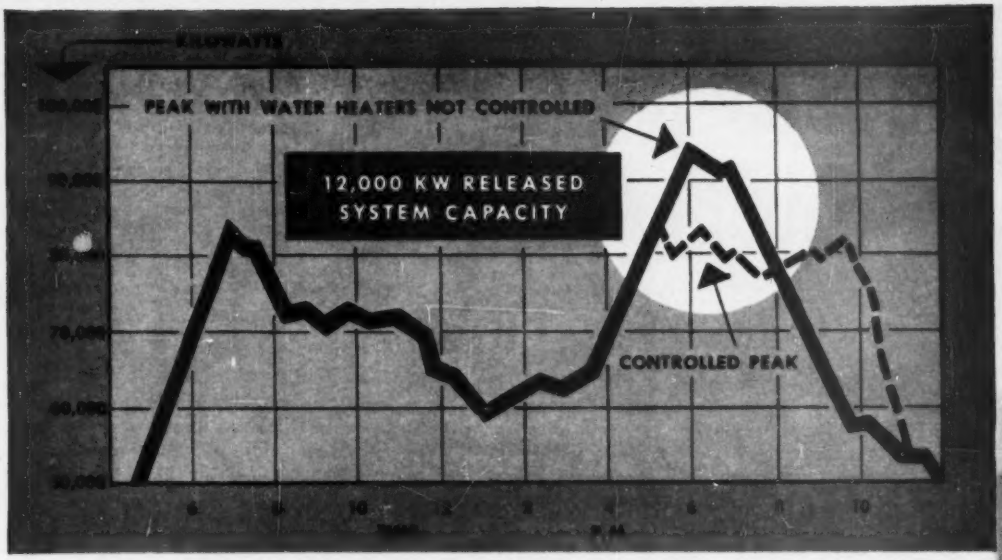
Capacity of the reel is 150 ft of concentrically wound ¾-in. manila rope whose inner end is attached firmly to the reel. This size rope has a safe load of 700 lb, with a safety factor of 7, and can consequently handle the majority of distribution transformers. The line does not require supervision by the groundman to align and adjust for tension as when wrapped on a capstan.

This removable reel of rope also eliminates the necessity of making up the bull line or block and tackle rigging for each job, or re-coiling and returning the rope to its usual storage place after each operation.

This reel is compact and conveniently stowable among other truckbody stock. Being easily removable, the problem of the customary "nigger-head" is not present, and the winch shaft may even be shortened.

HOISTING REEL with rope is mounted on line truck winch shaft

The reel illustrated cost only $10 for labor and material. End section was assembled on a 16-in. piece of 2½-in. ID tubing obtained from steam-plant scrap, with ½ hr required for cutting.



TYPICAL SUBSTATION LOAD CURVE IN AREA USING 20,000 WATER HEATERS SHOWS RELEASED LOAD THROUGH USE OF OFF-PEAK CONTROL

Released Capacity with Off-Peak Control... Fact or Fantasy?

A major benefit of off-peak control lies in its ability to release the available kilowatts between peak load *with* control and peak load *without* control.

The electric water heater load is expected to more than double in the next eight years. In 1960 annual sales of electric water heater sales will be an estimated 1,800,000 and the total annual water heater load will be approximately 35 billion KW hours.

RELEASED POWER

The capacity released in the distribution system (by off-peak control) can absorb additional domestic load—created, during the control period, by electric ranges, automatic washing machines, and other appliances. Savings result in deferred investment for new capacity.

FOR EXAMPLE

Let's assume that there are 20,000 electric water heaters on a system. Multiply this number by 0.6 (the average KW demand per heater) and get the number of KW's released in the distribution system. In this case it's approximately 12,000 KW's. Apply this simple formula to your own system and see how much capacity off-peak control can release for you.

COST COMPARISONS

Industry figures for the last six years show that each kilowatt of installed capacity costs approximately $500.*

The diversified contribution of each water heater to the total load is approximately 0.6 KW. Therefore, each water heater accounts for 0.6 x $500—or $300 of installed capacity.

Contrast this with only $25-50 per water heater installation for off-peak control.

LARGE SAVINGS POSSIBLE

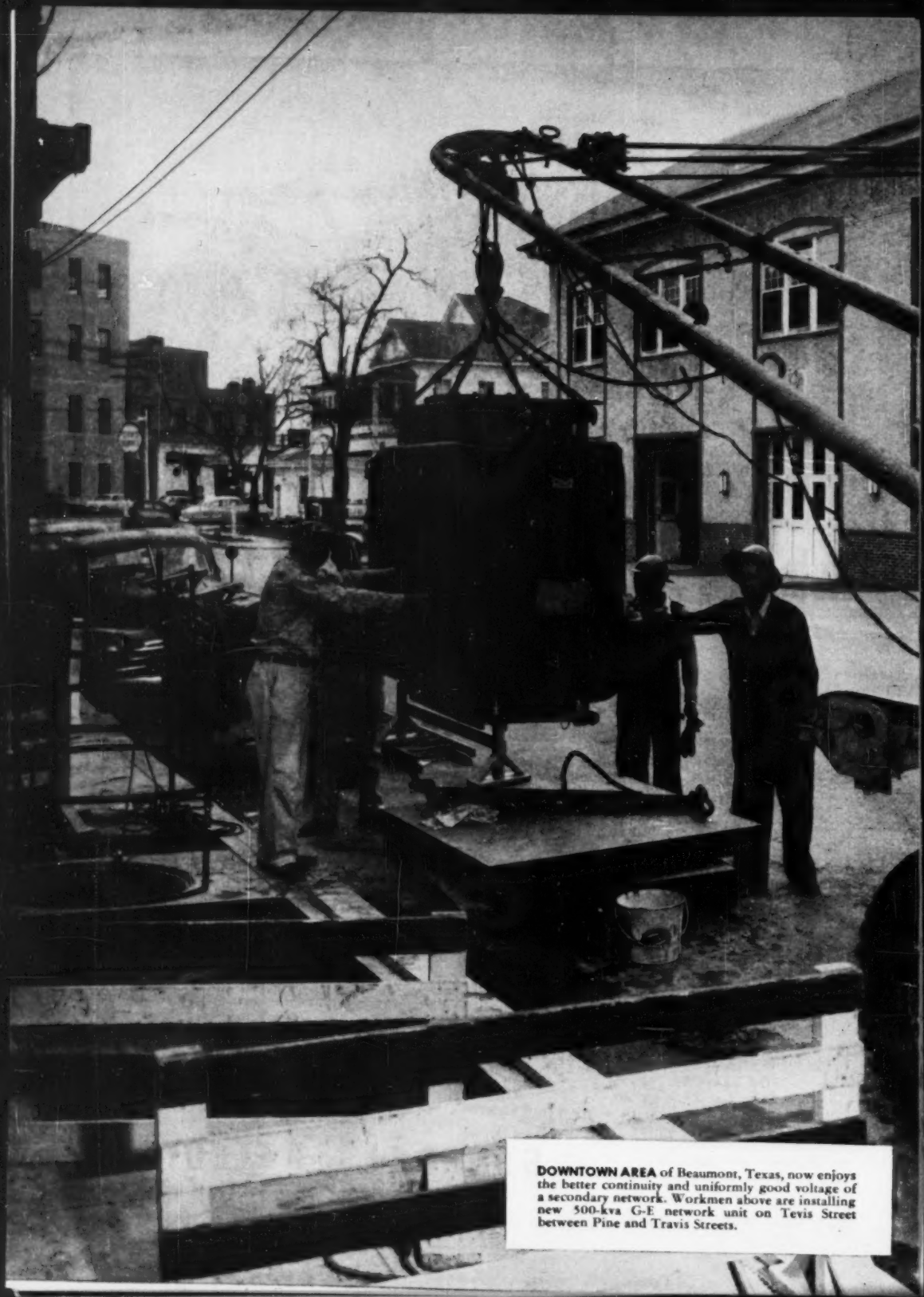
At a cost of $500 per kilowatt of new capacity, 12,000 KW of water heater load would cost approximately $6,000,000. Yet off-peak control makes it possible for new load to be added without necessitating new facilities to this extent.

SYSTEM STUDIES NEEDED

A thorough study of the economics of off-peak control (in the light of your own system) is needed if proper evaluation of individual requirements is to be made. Your General Electric Apparatus representative is prepared to discuss with you the possibilities which off-peak control may offer your own situation. For a more detailed report on the subject, write for bulletin GEA-5686 on the subject of off-peak control. Write to General Electric Company, Schenectady 5, N. Y. 603-143

**ELECTRICAL WORLD, Statistical Issue, Jan., 1951.*

GENERAL ELECTRIC



DOWNTOWN AREA of Beaumont, Texas, now enjoys the better continuity and uniformly good voltage of a secondary network. Workmen above are installing new 500-kva G-E network unit on Tevis Street between Pine and Travis Streets.

Beaumont installs a network to handle heavy load growth

Installation of this G-E network unit illustrates only step that will be needed in future to add new distribution capacity

As today's rapidly expanding urban loads make it difficult to perpetuate radial systems, more and more electric utilities install secondary networks.

They find that, once installed, a network gives them complete flexibility for solving load growth problems —on an orderly step-by-step basis—without any re-arrangement of secondaries or service entrances.

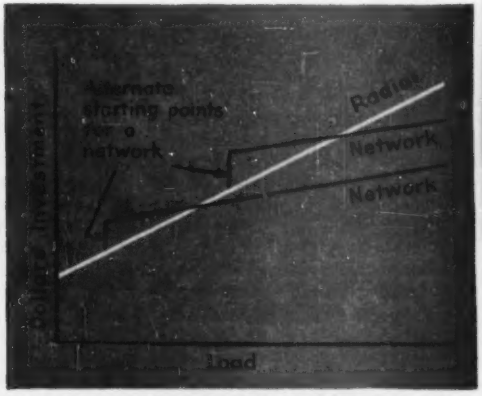
In Beaumont, Texas, for example, the Gulf States Utilities Co. found that it required extensive engineering calculations, juggling of existing loads and bolstering of circuits to meet increased loads in the downtown area. As a result it retired its radial system in favor of a network.

NO MORE LOAD GROWTH "HEADACHES". Now, when rising loads require additional capacity, all that will be necessary will be additional network units. With a network, service connections and low-voltage connections are provided initially thus eliminating any need for rearrangement or re-enforcement when a new transformer is added.

HELP FOR YOUR SYSTEM. If you, too, are struggling to accommodate new loads by perpetuating a radial system and your load density has risen to approximately 10,000 to 15,000 kva per square mile, it may be time for you to investigate the flexibility and economy of a secondary network.

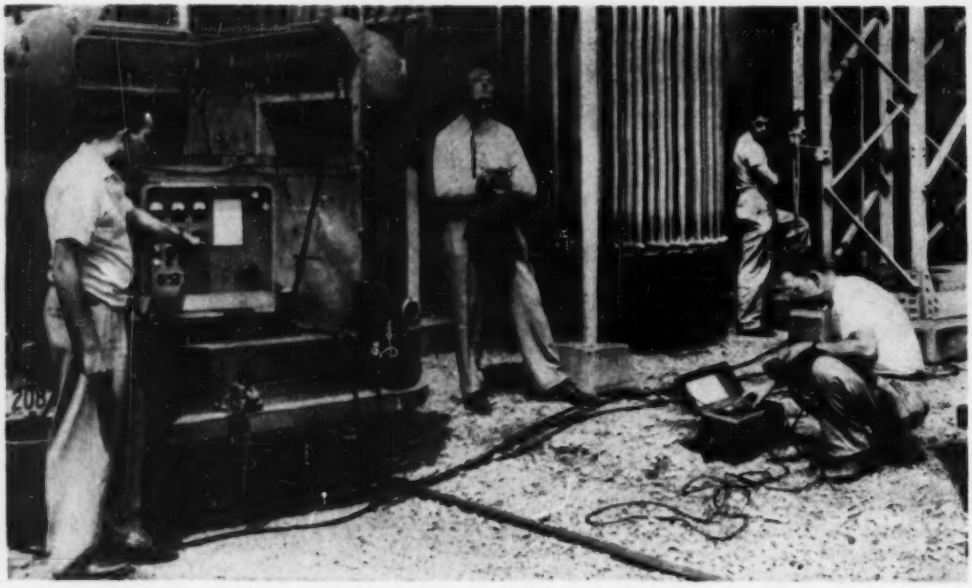
For help in solving your network problems, and for complete information on the many advantages of G-E standardized network units, get in touch with your local G-E Apparatus sales office. Or write to Section 402-129 for Bulletin GEA-5024. General Electric Company, Schenectady 5, N. Y.

VAULT SIZE MINIMIZED when you install G-E standardized network equipment since both high- and low-voltage cable terminals are well below the top of the transformer. Vault depth need be only 7 feet to roof slab to provide sufficient room for maintenance and inspection.



IT PAYS TO START A NETWORK. Although the change from a radial system to a network system means some initial expense, future increases in capacity require less investment with a network. And with a growing load, the sooner the network is started, the lower the ultimate cost.

GENERAL ELECTRIC



TESTING CABLE with an impulse fault locator and dc proof tester. The set weighs 300 lb excluding the portable detector

Fault Locator Weeds Out Incipient Cable Faults

JOHN L. REDMOND, Distribution Engineer, Indianapolis Power & Light Co, Indianapolis, Ind.

Weeding out of incipient faults in Indianapolis Power and Light Co's 4-kv cables during off-peak seasons has been so successful that no circuit has failed in service after a proof test was made. The instrument used, a 25-kv 1.65 mf impulse type fault locator and dc proof tester, was purchased in 1951.

IP&L is using the tester for checking 4-kv and 13.2-kv circuits. Of the 55 4-kv cable circuits tested, 23 had a total of 46 incipient faults that failed under test. The failures occurred in these components: junction box bushings, 10; splices, 13; cables, 21; and potheads, 2. All failures were located with a detector, 90% without any difficulty. Several faults in splices and junction box bushings cleared when the test set was switched to fault locating but eventually broke down.

Advantages . . . The new instrument replaced one designed by IP&L that was rated 8,000v at 60 cps. The disadvantage of the tester previously used was that only ½ of a 4-kv feeder could be tested because of charging current limitations. No such limitation exists with the new tester.

Junction boxes that were incorporated in cable circuit design for test sectionalizing are not needed with the new instrument. Many of these boxes were obsolete and defective. Elimination of these boxes saved IP&L an estimated $12,000.

Other advantages of the impulse fault locator over the ac locator are:

1 The impulse locator uses 500 va and can be plugged into any 120-v grounded outlet as compared to 15 kva required by the ac locator.

2 Circuits up to 23 kv can be tested with the new tester; it is 95% effective on 33-kv circuits. The ac set is not effective on 33-kv circuits.

3 A pickup coil is employed with the impulse locator that indicates the direction of a fault from manholes or cable bondings.

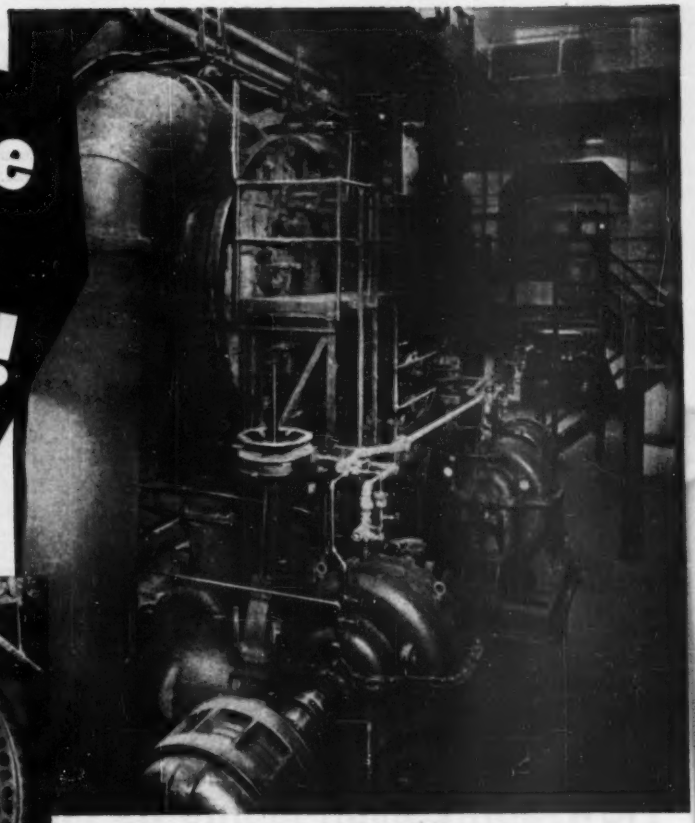
4 In addition to being more positive, the impulse locator saves time that was required for sectionalizing the feeder.

Operation . . . The impulse fault locator is a tracer current type that utilizes capacitor discharge for the signal current. Two 12.5-kv capacitors connected in series are charged on alternate cycles in a voltage doubler circuit and discharged every 3 seconds into the circuit under test. The output voltage is adjustable from 0 to 25 kv and is read on a voltmeter.

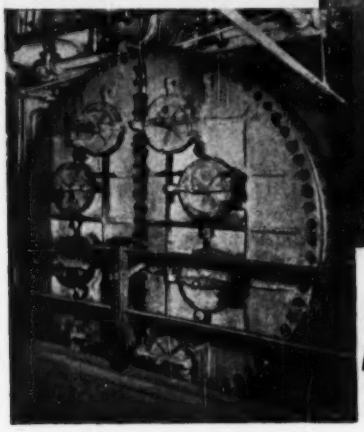
To locate the fault, a pickup coil detector is applied to the faulty cable. A zero center microammeter, connected to the pickup coil, will have a positive deflection when the detector is between the instrument and first sheath bond beyond the fault. There will be no meter deflection beyond the fault unless it is a delayed breakdown. In this case, the meter will indicate the opposite polarity beyond the bond because the charge on the cable discharges through the fault.

When testing multi-conductor cables, the detector should

Before you SCRAP!



Condenser of the Lynn Gas & Electric Co., Lynn, Mass., which was returned to service by use of inlet-end inserts at a saving of $30,000.



Before you scrap condenser tubes because of inlet-end leaks

GET ALL THE FACTS

It sometimes happens that a combination of erosion and corrosion at the inlet ends of condenser tubes may seem to force their replacement. This is not always necessary. If the damage is confined to a small area at the inlets, and the tubes otherwise are in good condition, they can be saved by using inserts designed especially for just such circumstances. There are several makes available, none made by Revere.

In a recent case, involving a condenser of the Lynn Gas & Electric Company, Revere recommended inserts. Here are the figures: Number of tubes involved, 4,100; Replacement cost, $35,000; Cost of inserts to cure the trouble, $5,000; Saving, $30,000. Repairs should enable the condenser to serve for several more years. The work was so successful that a similar job was done on another Lynn condenser containing 2,700 tubes.

Of course Revere wants to sell condenser tubes, and its other products in copper and copper-base alloys, and aluminum, but we know that fast friends and loyal customers are won by taking to heart the best interests of those with whom we deal. May we have the privilege of working with you on condenser tube matters? Send for free booklet, "Life Extension for Condenser Tubes."

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

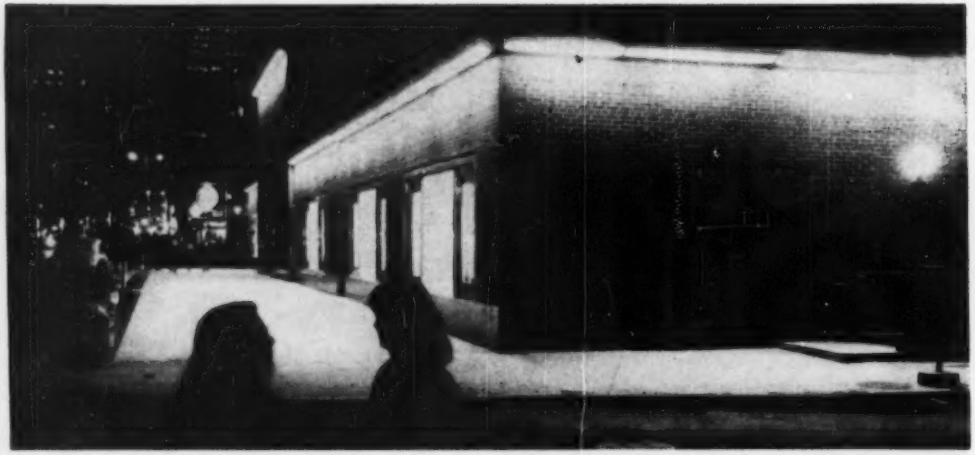
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities. Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

be rotated around the cable to obtain the maximum signal. The strength of this signal around the cable will vary because the faulty conductor is not symmetrical with its sheath. This maximum signal will be practically constant, along the cable, to the fault or bonding beyond.

For proof testing, a voltage of 16 kv dc is applied to 4-kv circuits; 26 kv dc is applied to 13.2-kv circuits. An ammeter measures the leakage current. If the leakage current shows a downward trend or remains constant for 5 minutes the cable is satisfactory. An increase in current after 5 minutes usually designates an incipient fault. The test is continued. In one case it required 20 minutes for complete breakdown.

Precautions . . . There are two precautions to be followed when using this instrument: first, all transformers and lightning arresters should be isolated from the cable before testing commences. And second, the cable under test should be grounded following each test. A manual grounding switch is provided on the panel for this purpose.



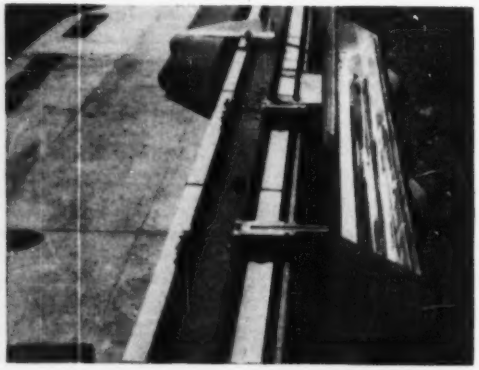
EVEN GLARELESS LIGHT is achieved on sidewalk by matching two-level lights. Light does not disturb traffic or neighbors

How Con Edison Lights Its Sidewalks

Sidewalk lighting for Consolidated Edison's New York buildings, as developed on their 19th Street substation, is glareless so it will not disturb street traffic or apartment dwellers. Fixtures are hinged for maintenance from roof, and are integrated into building structure. The cool white slimlines are protected from the cold by lightly frosted Plexiglas. Six and eight-ft units form a 380-ft band.

With the station roof at two heights, design required different light outputs to achieve even light on the sidewalk. The standard T-12 lamps the 28-ft level operate at 600 ma, those at the 14-ft level at 430 ma, maintaining 10 ft-candles average intensity on the sidewalk.

LIGHTING becomes integral part of building's architecture



BULB REPLACEMENT is done on roof with hinged fixtures

Get Sound Bus Joints the Easy Way!

Neoprene Boot Simplifies Installation!

Only Allis-Chalmers Switchgear Uses This Method of Bus-Joint Construction

USERS OF ALLIS-CHALMERS Switchgear make or inspect bus joints in a fraction of the time and with none of the mess involved with any other switchgear. Best of all, it's a strong, corona-free joint meeting full impulse levels.

See how simple it is to make the bus joint. It's as easy in the field as it is in the factory. And note the construction details of these rigid joints.

This is but one of many advantages of Allis-Chalmers Switchgear. Get the full story from your nearby Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

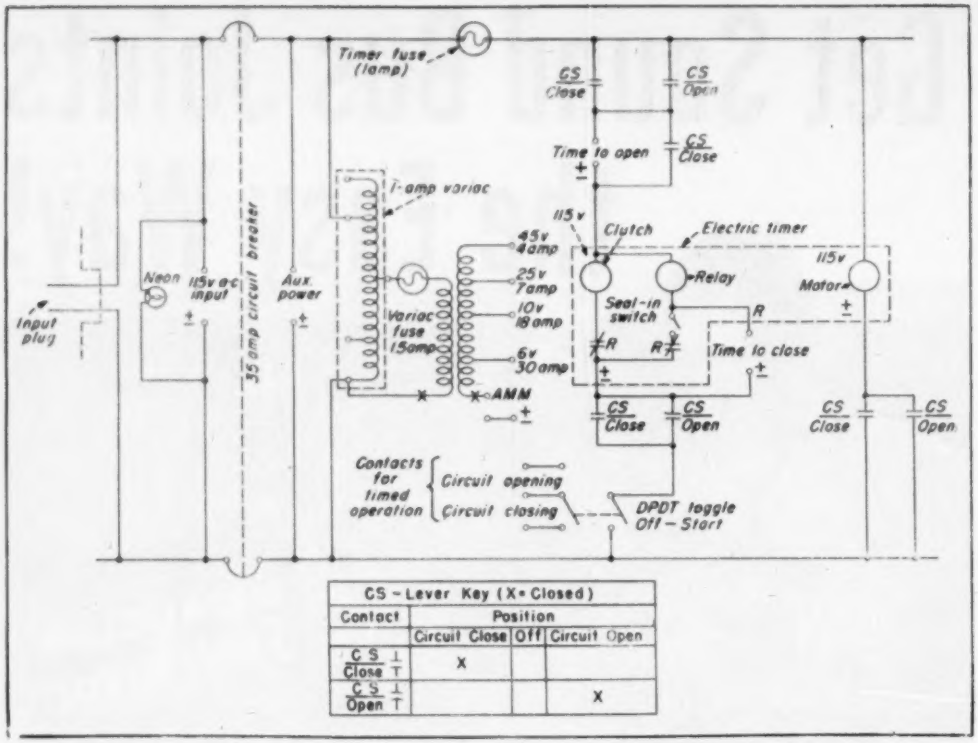
A-7863

HERE'S HOW BUS JOINT IS MADE

1. Bus bar connections are of round edge copper bar with at least 98 percent conductivity. Connections are silver plated to reduce contact resistance, and prevent overheating and oxidation. A combination of spring washers and lock washers assures 'proper contact of bars at all times. Slotted bolt holes permit expansion and contraction of bus . . . relieve strain on structure.

2. No-corona tape of copper mesh material is applied around the bolts and the overlapping joint. This eliminates corona in the connections and provides a uniform base for the Neoprene rubber boot. Special Neoprene boot with potential transformer tap is provided. A few turns of electrical tape hold the boot in place. No fuss, no muss, no liquid compounds.

ALLIS-CHALMERS



CS – Lever Key (X = Closed)			
Contact	Position		
	Circuit Close	Off	Circuit Open
CS Close	X		
CS Open			X

FIG 1—RELAY ELEMENT is checked with tester using time-to-close terminals with timer key set at circuit close. Opening time of any electrically operated contact device is checked using time-to-open terminals with timer key set at circuit opening position

Check Overcurrent Relay Elements with Portable Tester

E. D. ANDREWS, System Relay Technician, Idaho Power Co, Boise

Testing the operating time of any kind of overcurrent relay element can be done quickly and easily with a portable relay tester developed by Idaho Power Co. Also, the tester can be used to check the tripping, closing and trip-reclosing times of oil circuit breakers and the opening or closing time of any electrically operated contact device.

Unit consists of a 35-amp breaker, a 1-amp Variac, a transformer with taps for current ranging from 30 amp maximum at 0-6v to 4 amp maximum at 0-45v, and a timer calibrated in cycles, seconds and hundreths of a second. Various switches and terminals are included to allow the setting up of closing and opening tests and to permit the several currents to be taken to the device under test. A separate portable ammeter is used in adjusting current to the proper value. Variac brush is fused at 1.5 amp.

All equipment except the ammeter is housed in a steel box 17 in. long, 11 in. wide and 5 in. high, weighing about 45 lb. Unit is supplied from any 120-v source.

To check the timing of an overcurrent element, timing key is set at circuit closing (Fig 1). Test leads are connected from relay contacts to proper terminals (time-to-close) on the tester and current leads are run from the tester to the relay. After current is adjusted to the desired value through the Variac, timer is reset to zero and circuit breaker is closed, applying current to the relay and starting the timer simultaneously. Timer runs until its clutch is disengaged by the closing of the relay contacts. To check the opening time of a device the procedure is the same except that time-to-open terminals on the tester are used and timing key is set at circuit opening.

When oil circuit breakers are to be checked, they are taken out of the circuit and test leads are connected

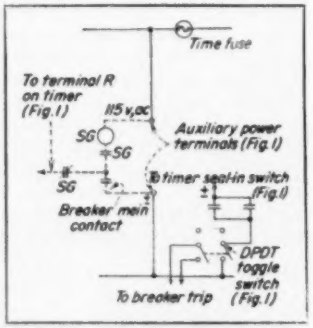
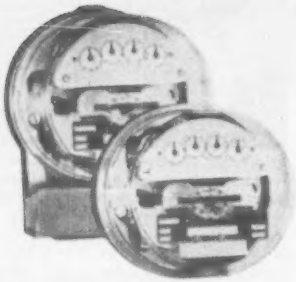
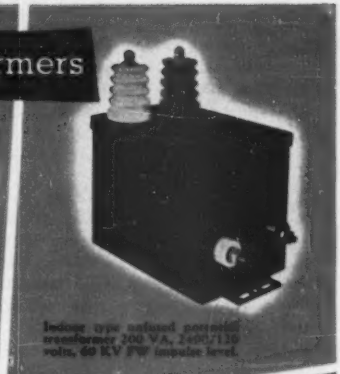


FIG 2—TRIP-RECLOSE TIME of breaker is checked with an auxiliary relay, such as an SG. Relay is closed manually before test

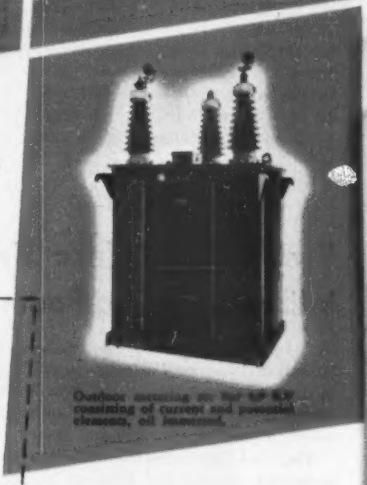
current, potential and metering transformers



Type NAS indoor current transformer. Primary current ratings of 200, 400 or 600 amperes. Capacity 25 volt amperes.



Indoor type outdoor potential transformer 200 VA, 2400/120 volts, 60 KV BIL insulation level.



Outdoor metering set for 69 KV consisting of current and potential elements, oil immersed.

When accuracy is a factor

In the field of measurement for precision metering, operation of indicating instruments, relays and control apparatus, there is no substitute for accuracy.

The Standard Transformer Company has designed and is manufacturing a complete line of accurate current and potential transformers for every application... current, potential and metering transformers for any voltage up to and including 72 KV, and at any specified frequency. All thermal and mechanical ratings in accordance with industry's requirements and standards for each specific use. All standards set by ASA and EEI-NEMA in respect to accuracy are met.

Many prominent manufacturers of switchgear and control apparatus are regular users of STANDARD current and potential transformers. Our production facilities are flexible and engineering skill versatile enough to produce quickly transformers of special design to meet your specifications. Call in your STANDARD representative for further information.

everything points to

WRITE FOR BULLETIN
S-501-B

32 pages of detailed drawings, accuracy limits, ratio and phase angle curves for current, potential and metering transformers. Write for your copy today.

Standard

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

directly across the main contacts. Circuit closing contact of the tester is connected to the proper relay on the breaker. Setting the off-start switch to start energizes the breaker relay and starts the timer. Opening or closing of the main breaker contacts stops the timer.

Checking the trip-reclose time of a breaker requires an auxiliary relay, such as an SG. Circuit closing contact of the tester is connected to the trip circuit (Fig 2). A break contact of the auxiliary relay is connected in series with the timer clutch and a make contact in series with the auxiliary relay coil. Clutch and auxiliary relay coil are connected in parallel and the breaker main contacts are connected in series with them. With breaker closed, auxiliary relay must be operated manually to de-energize timer clutch (it will seal in). Placing the off-start switch in start energizes the trip circuit and starts the timer. When breaker main contacts open, auxiliary relay becomes de-energized, and when they close again the clutch is operated (thru auxiliary relay break contacts) to stop the timer. Time measured is that from trip coil being energized to breaker main contacts closing again. Timer has a seal-in circuit which prevents further timing when breaker opens again after reclosure.

Manufacturers warn against using phantom load type of current source for testing induction type relays. Because of this, output of the testers was carefully checked with a sonic analyzer and third harmonic content was found not to exceed 10%. Differences in relay times, as obtained between resistance and phantom load types of testers used on same relay, were smaller than the 3% error of portable ammeter used, which is entirely satisfactory.

RELAY TESTER permits any kind of overcurrent relay element to be checked against curves of operating characteristics. Tester may be used to check circuit breakers

Two Men Replace Six With Hydraulic Boom Truck

A line truck mounting a hydraulic-operated, articulated boom with two crows' nests has recently been put in service by Consolidated Edison Co of New York, Inc. This type of lift is designed for overhead operations and provides safety, economy, versatility and maneuverability.

The truck is used primarily for tree trimming and for inspecting, splicing and repairing aerial cables and overhead lines. In addition to normal maintenance work, the lift truck proved its value in a cleaning-up operation after a heavy windstorm last June.

Two non-tipping, waist-high crows' nests, equipped with standard safety belts, enable operators to work at heights up to 40 ft, face in any direction and have both hands free at all times.

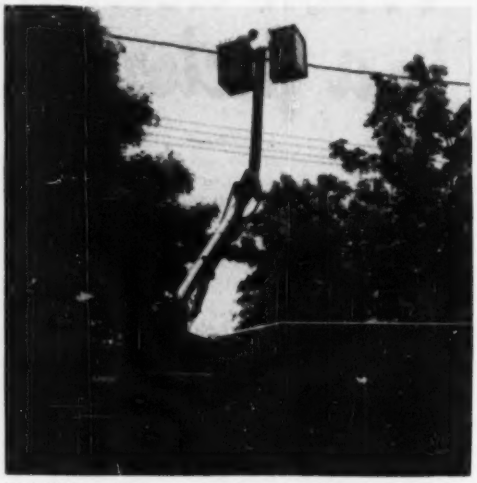
One lineman and a driver operate the equipment. They replace a six-man crew with foreman normally used in tree-trimming operations. The double crows' nests permit the use of an additional man when necessary. The boom or lift eliminates time-consuming shifting and lashing of ladders and will carry men to places where ladders cannot reach.

The hydraulically operated, chain and sprocket-drive lift carries two men and tools and equipment weighing up to 500 lb to a height of 40 ft. The boom has a reach of 26 ft from its moorings, and revolves through a complete circle with full articulation at the elbow.

Controls for the boom are mounted on one of the buckets. A duplicate set is located at the base of the lift. A power take-off from the truck's transmission operates the hydraulic pump while electrically motivated outriggers controlled from the cab provide stability for the truck and lift.

The lift is mounted on a standard chassis with a front end assembly from the next larger size truck to provide easier steering. Standard Con Edison line truck bins are mounted on either side of the chassis with an open space between for equipment and cable, or tree cuttings. The truck carries the usual line truck equipment and tools.

Special equipment includes pruning hooks and reciprocating saws driven by compressed air from a 12-cu ft compressor. In addition, the truck has both chain and reciprocating electric saws powered by a 180-cycle generator or from any 120-v circuit. Air outlets are also located on either side of the chassis so the compressed air tools can be operated from the ground if desired.



ARTICULATED LIFT on line truck facilitates inspection of aerial cable in locations not easily reached by ladder. Insulation on outer boom provides an added margin of safety

1500 KVA INDOOR SUBSTATION TRANSFORMER

COMPACT
DEPENDABLE
for
INDUSTRIAL
SERVICE

This 1500 KVA Uptegraff indoor Unit Substation Transformer is one of three identical units supplied complete—including switchgear—by Uptegraff for a large mid-western industrial firm. The sturdy design of core and coil assembly is clearly evident in the photograph at the left. The strong, rigid tank is designed to withstand eight pounds pressure or vacuum. Transformer is designed for sealed-tank operation, and a super-sensitive electronic leak-detector is used to insure that even the smallest leaks in tanks and bushings are completely eliminated. Transformer is rated at 1500 KVA, 2400-480 volts, 3 phase.

R. E. UPTEGRAFF MANUFACTURING CO. SCOTTDALE, PENNSYLVANIA

Properties of Fluorochemical O-75

This inert fluorochemical liquid is a fluorinated cyclic ether. It is classed as a liquid dielectric and a heat transfer fluid. Accompanying data are preliminary and have been furnished by Minnesota Mining and Manufacturing Co.

Fluorochemical O-75 is nonflammable and nonexplosive. It is unique in thermal stability and can be heated up to 600 C (1100F) without evidence of decomposition. It is very stable in the presence of water vapor at high temperatures.

At ordinary temperature (below its boiling point) this chemical has essentially no chemistry, nor does it react with alkalies, strong acids, oxidizing or reducing agents. Similarly, the liquid will not swell common plastic or resinous materials, fluorinated polymers or paper. Up to 300-400 C (575-925 F) the fluid will not corrode metals. Decomposition by arcs and sparks is resisted.

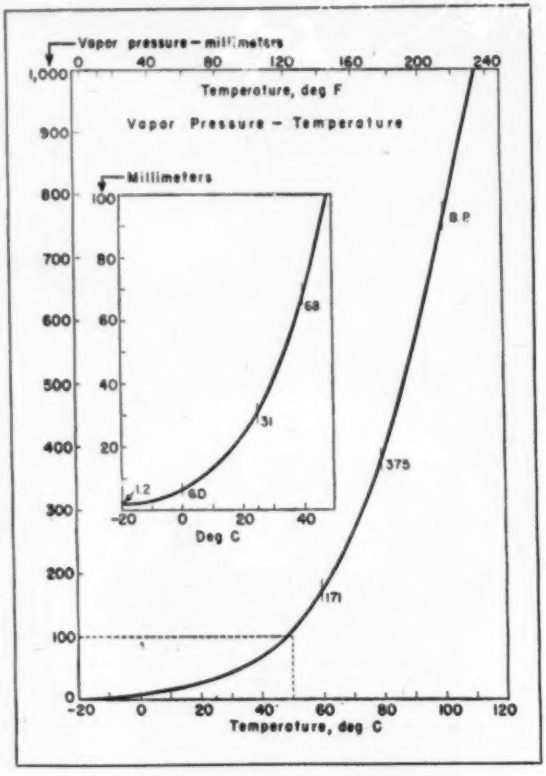
Toxicity: For substantial quantities handled no toxic or anesthetic effects have been observed.

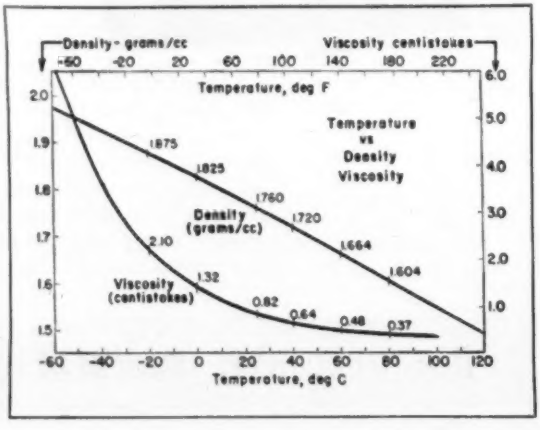
Applications: Capacitors, contactors, circuit breakers, high frequency equipment, instruments, meters, relays and transformers.

Physical and Electrical Properties

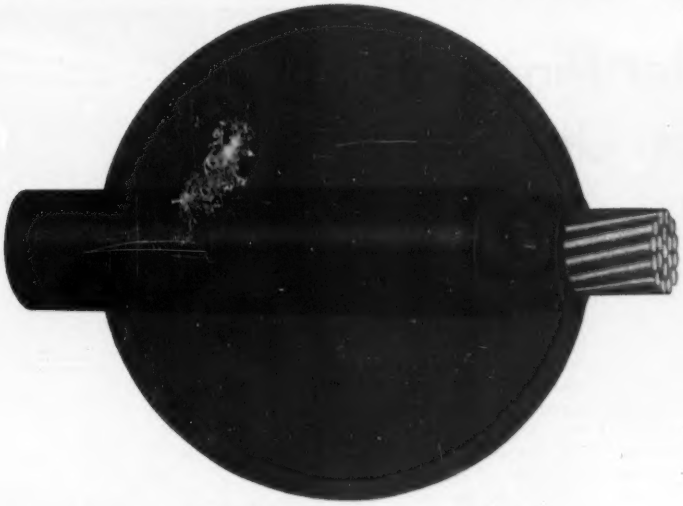
Formula	$C_8F_{16}O$
Physical State at Room Temperature	Colorless liquid
Odor	Odorless
Formula Weight	416
Boiling Point	101 C (214 F)
Freezing Point (Glass Point)	−113 C (−171 F)
Pour Point	−100 C (−148 F)
Density* (g/cc at 25 C, 77 F)	1.760
Viscosity* (centistokes at 25 C, 77 F)	0.82
Refractive Index (25 C, 77 F)	1.276
Surface tension (dynes/cm at 25 C, 77 F)	15.2
Coefficient of Volume Expansion (per deg C) (25-40 C, 77-104 F)	1.6×10^{-3}
(40-80 C, 104-176 F)	2.0×10^{-3}
Specific Heat (cal/g/deg C at 25-40 C, 77-104 F)	0.26
Heat of Vaporization (cal/mole at b.p.)	8,700
(cal/g)	20.9
Thermal Conductivity, Liquid (Btu/hr/sq ft/deg F/ft) (25 C, 77 F)	0.071
(60 C, 140 F)	0.054
Dielectric Strength (ASTM-D877)	37 kv
Dielectric Constant (100 cps at 25 C, 77 F)	1.85
Power Factor (100 cps at 25 C, 77 F)	0.0005
Volume Resistivity (ohm-cm at 25 C, 77 F)	10^{14}-10^{15}

*See graph





SIGNAL AND CONTROL WIRING • SHOP WIRING • REWIRING



SIMPLEX ANHYDROPRENE WIRES

For wiring installations where the use of ducts is required, you'll find ANHYDROPRENE Wires hard to beat for long, trouble-free service and economical operation. The reason? ANHYDROPRENE'S Anhydrex insulation and thin — but tough — neoprene jacket are more than equal to the hazards that make short work of ordinary wires. In addition, they contribute to low-cost installation and maintenance.

Take a look below at the features they provide and you'll see what we mean. Specify ANHYDROPRENE for your future wiring jobs and you'll see what **they** mean in more-satisfactory performance and in dollars saved.

- Flexibility
- Light Weight and Small Diameter
- Unexcelled Resistance to Water and Moisture
- Protection against Oils, Grease and Flame
- Resistance to Acids, Alkalies and Corrosive Chemicals
- Elimination of Braids that Fray and Rot
- Easy Pulling through Ducts without Use of Lubricants
- Molded or Stamped Markings for Instant Identification

For more-complete information write for Bulletin 115.

Simplex - WIRES & CABLES

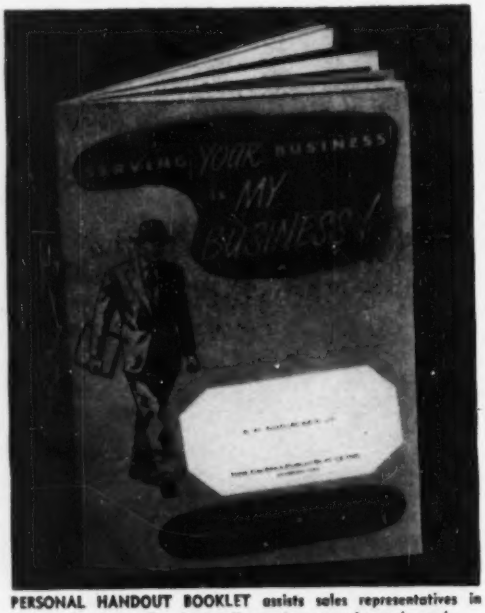
SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET,
CAMBRIDGE 39, MASS.

Booklet Pinpoints Needs, Ups Sales

JOHN D. HAVERKAMP, Commercial Supervisor, New Orleans Public Service Inc.

Sales representatives of New Orleans Public Service Inc. believe that a small booklet in use by them for the past two years, is the best attention-getter so far devised for universal application with all classes of customers. It has proved invaluable in promoting good customer relations and increased usage and retaining existing load. It is particularly good as a door-opener with new customers, and is used as the basis of practically all first calls.

The booklet "Serving YOUR Business Is MY Business" has given definite proof of its worth. It is designed for personal delivery to all customers by the sales representatives. Upon delivery its contents are discussed in whole or in part with the intent to pin-point the discussion on some particular utility service which would be of advantage to the customer.



PERSONAL HANDOUT BOOKLET assists sales representatives in making customer calls. It visually supplements salesman's words.

Many Testimonials

Here are a few results obtained through the use of the booklet in the words of the sales representatives:

• I was making a routine call on an appliance store and opened the interview by using the booklet as a guide. Hot weather was just around the corner so I focused the customer's attention on the subject of ventilation. Through this assistance I secured consent for a ventilation layout. The job subsequently was installed as recommended.

• A laundry was given a copy of the booklet along with an explanation of the services we have to offer. The result was the request for a lighting layout, followed by installation as recommended.

• Through use of the booklet we secured four lighting layout requests from the owner of a new apartment house with stores on the ground floor. The lighting is now in use.

• While discussing the various services offered by our company, through the use of the booklet I was able to get the customer interested in an air conditioning installation, even though the discussion took place during the winter. As a result, a lead to a dealer was secured and the job is now completed, ready for use in hot weather.

• While using the booklet I was able to point out to the owner of a clothing store that we designed window lighting. Result—a lighting layout followed by a Planned Lighting installation.

• Merely opening the booklet to the section on Planned Lighting was enough to bring questions on lighting by the owner of a barber shop. This led to a relighting job.

• A discussion of the Air Conditioning section of the booklet led to the installation of ten tons of year-round air conditioning in a doctor's clinic.

• The owner of a printing shop wanted to know more about ventilation after seeing the booklet. He has since installed 3 fans as recommended.

• The beauty parlor operator became interested in lighting maintenance. The maintenance contract can be credited to the use of the booklet.

• The dealer was called in and sold the grocer a display case. Mark up an assist through the use of the refrigeration section of the booklet.

• I used the booklet's lighting section. The light meter illustration interested the customer as well as the paragraph on dealer cooperation. I secured a lead on new fixtures and the dealers sold them.

These are but a few of the tangible results since the booklet was placed in use. Both the sales representatives and the customers like the booklet and it is certain that the objectives of the booklet are being reached both in tangible and intangible ways.

Other Services

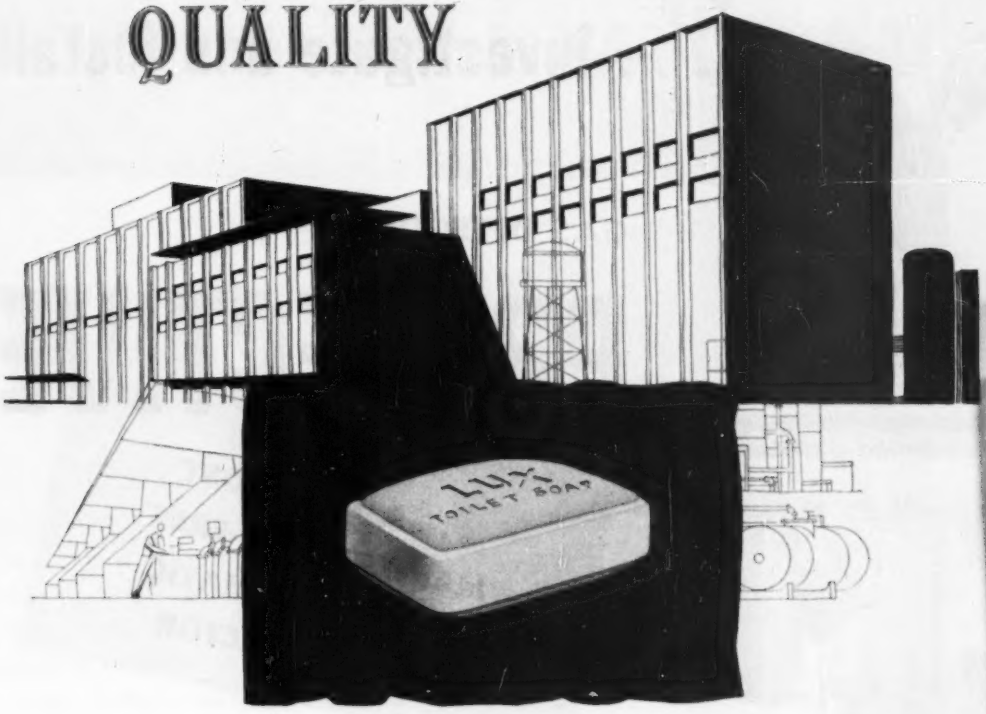
The New Orleans Public Service Inc, like many utility companies, offers a wide variety of services to its customers. To keep in touch with customer progress and problems, all customers are personally called on at various intervals of time. This interval may be as short as one month for large consumers of electricity, or it may be as long as six months for the smaller one.

With such frequency of calls and such a diversity of subjects for possible discussion, it is imperative that the sales representative plan his customer interview for maximum advantage to both the customer and the utility com-

(Continued on page 103)

the Accent's on

QUALITY



...so Lever Brothers selected quality-controlled

SPANG CENTRAL CONDUIT

to protect electrical lifelines

In the most modern soap and shortening plant in the world—recently dedicated in Los Angeles County—the emphasis is on product quality, as in all Lever Brothers Company factories.

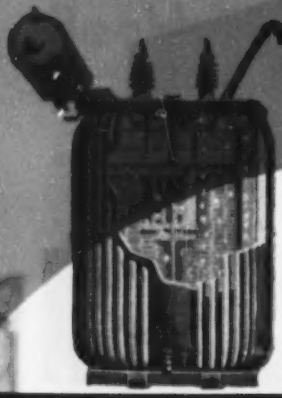
Every part, every machine, was selected with the greatest care to eliminate interruptions that might affect the exact, careful blending of raw materials. Electrical lifelines, for instance, are safeguarded by Spang "Cenlaco" Conduit—the conduit that's quality-controlled so it is always uniform in every way, always free from defects.

Wherever reliability is a must—easier, faster installation important—outstanding architects, contractors and owners specify conduit by Spang. Approved by the National Board of Fire Underwriters and complying with the National Electrical Code, it's *made better* for *better protection* of electrical circuits.

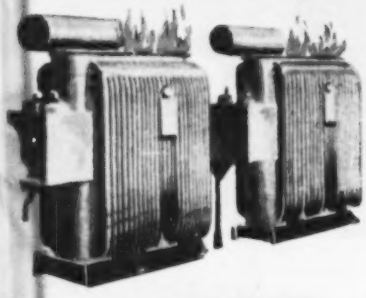
Owner:
Lever Brothers Company
Designers and Builders:
The Bechtel Corporation
Electrical Engineering:
The Bechtel Corporation
Consultant Architect:
Walton Becket and Associates

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE
GRANT BUILDING, PITTSBURGH 30, PA.
District Offices and Sales Representatives in Principal Cities

Protect *Yours* system against . . . investigate and install



Warns of gas generation



prevents equipment loss by fire

prevents area blackouts

GAS DETECTION

PROTECTIVE

. . . A LOW COST MAINTENANCE-FREE FULLY AUTOMATIC FAULT DETECTOR

THE SAVOISIENNE RELAY DETECTS ALL THESE FAULTS:

TYPE OF FAULT	*Successive operation of the contacts*	
Closure of a circuit by grounding of one bolt of the magnetic circuit	ALARM	
Short circuit between magnetic circuit bolts	ALARM	
Short circuit between magnetic circuit laminations	ALARM	
Poor contact in one of the electric circuits	ALARM	
Spark from an insulated metal part to ground	ALARM	
The oil level drops below the permissible limit	ALARM	TRIPPING
Eventual air suction by the oil circulation pump	ALARM	
Breakdown of an insulating part		TRIPPING
Short circuit between turns, coils or taps		TRIPPING
Breakdown of a live part to ground		TRIPPING
Very high accidental excess voltage	ALARM	TRIPPING

The SAVOISIENNE Protection Relay is distributed throughout North America exclusively by

SUPREME POWER SUPPLIES LIMITED

MIMICO ONTARIO CANADA

Manufacturers of "Smooth-a-Surge" Transformers and Supreme Unit Sub-Stations

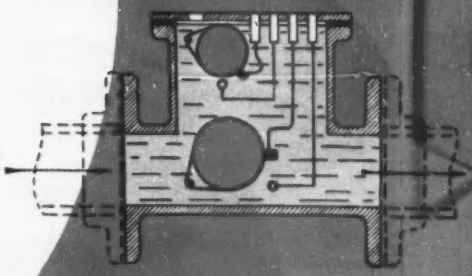
costly failure due to transformer faults this new simplified protective relay!

RELAY...

Now you can count on positive protection against internal faults of immersed electrical apparatus. The new SAVOISIENNE Protective Relay automatically operates a central alarm system, gives immediate warning of transformer troubles before the danger point is reached.

Get the facts which tell you how you can eliminate the possibility of power breakdown or fire, and maintain uninterrupted service to your plant or community. Complete and mail the coupon for full information and technical data on the SAVOISIENNE Protective Relay—your best insurance against costly damage, more costly repair.

DELIVERY FROM STOCK



The very reliable operation of the Savoisienne relay causes the closing, or, upon request the opening of two mercury switches one of them controlling an alarm signal and the other one the tripping device of the circuit breaker.

Direct United States Enquiries to
MILES HENNINGER,
Suite 1506
606 W. Wisconsin Ave.,
Milwaukee 2, Wis.

I'm interested in the new SAVOISIENNE Protective Relay. Please send me complete information.

Name .....

Company .....

Address .....

.....

6 BIG REASONS WHY VICTOR PURIFIED PORCELAIN SWITCH and BUS INSULATORS ARE BETTER!

VICTOR NO. 742 (NEMA TR-No. 7). For complete engineering data on all Victor Switch and Bus Insulators, send for Bulletin No. 5.

1. Improved thermal resistance. Purified Porcelain, pure porcelain all the way through, expands and contracts more uniformly during sudden temperature changes.
2. Unmatched porcelain hardness and density, resulting in rock-like strength.
3. Higher average puncture values.
4. Better tension, torsion, cantilever and impact values.
5. Smoother, harder glaze with unequalled self-cleaning characteristics.
6. Finest insulator porcelain ever made—uniformity of quality never before achieved!

Specify VICTOR

VICTOR INSULATORS, INC., VICTOR, N.Y.

Booklet Pinpoints Needs

(*Continued from page* 98)

pany. This is where the booklet is of major assistance as it affords a means of visually supplementing the sales representative's words and furnishes a focal point to hold the customer's interest.

In brief the booklet is used:

With new customers to acquaint them with all of the utility services.

With all customers to keep them reminded of all the services the utility is ready to render.

With any customer to pin-point the discussion to some particular service which would appear to offer most advantages for the customer.

To keep the customer continually informed of the name of the particular sales representative handling his account.

To be left with the customer as a reminder of the many utility services after the sales representative has left.

The booklet is used only as a personal handout piece and is never mailed. Its front cover is slotted to hold the business card of the sales representative.

Properly used the sales representative endeavors to explain each service as he and the customer review the booklet. The interview is then pointed to a particular service offering the major advantage to the specific customer. An attempt is made to get the consent of the customer to a course of subsequent action, to result in better and more complete use of the utility services.

The booklet consists of 12 pages and in quantity can be printed for approximately 6¢ each. A copy is available to anyone in the industry who requests it. Such request should be directed to the attention of the writer at 317 Baronne Street, New Orleans, La.

Electric Gimmicks Pull Home Buyers

Scene was set

Crowds came

Saw electrical equipment

And cooling towers, as . . .

Year-round air conditioning, adequate wiring and all-electric kitchens are among features that caused crowds to stampede Dallas' new 210-unit, low-cost housing project when the sample house was shown last spring.

Full air conditioning with common ducts for heating and cooling, certified wiring and plumbing for easy installation of the electric dishwasher and waste disposer, electric clothes washer and dryer are standard equipment furnished with every house. Other appliances and furnishings were displayed in the model home as part of the design for better living.

Wiring consists of:

No. 4 service entrance
100-amp entrance switch
1—50-amp 120/240-v range circuit
3—20-amp appliance circuits
2—15-amp lighting circuits
1—30-amp 120/240-v air conditioning circuit
1—120-v blank terminal

A cooling tower outside the rear of the house dissipates heat from the air conditioning equipment.

Cost of the complete heating and air conditioning system was $1,500. Operating costs are $93 a year for the normal cooling system in the Dallas area. Gas heat is used.

ELECTRONIC DRYER increases production of ceramic extrusions of small diameter and requires approximately 30 feet less floor space than a comparable tunnel kiln. Drying time is reduced 60 to 70% thereby reducing handling costs and breakage

Drying Time for Ceramic Extrusions Cut 70%

W. **G. DAVIES**, Chief Power Sales Engineer, Electric Power Board of Chattanooga, Chattanooga, Tennessee

Ceramic extrusions are being dried with a 63-kw electronic dryer in a production process by the American Lava Corporation, Chattanooga, Tennessee. This process has increased production with less floor space devoted to drying. It has enabled them to streamline the production line and reduce drying time 60 to 70%. A comparable tunnel kiln would have been approximately 50 ft long, whereas the electronic dryer is only 20 ft long. The reduction in handling, besides saving time, reduces breakage. Highest quality of ceramic extrusions is maintained by sampling procedures, employing smaller electronic dryers for checking drying shrinkage during the production process.

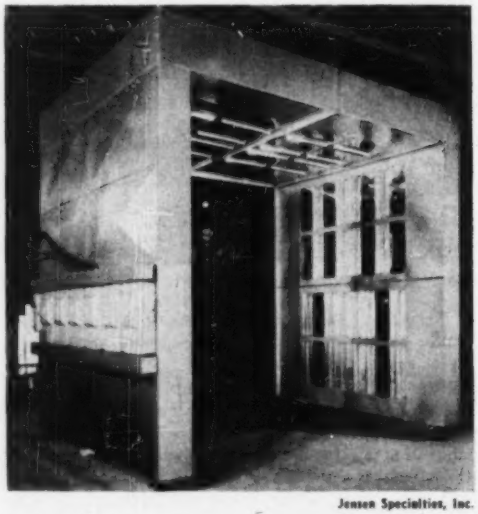
The production dryer is rated at 63 kw, 3 phase, 460 v and operates at 6 megocycles.

Mobile Electric Oven Goes To Work

This 140-kw mobile type radiant infrared oven goes to the work instead of taking the work to the oven. It has its own electric motor drive and operates on a wide gauge track for heating products too heavy or too bulky for normal handling on dollies or conveyors.

It is being used at Aberdeen Proving Grounds for a variety of heating applications up to 300 F including paint baking, expansion of metal components for shrink-fit assembly and preheating of armor plate prior to welding. The oven is approximately 12 ft wide by 12 ft high by 10 ft long. It uses metal sheath heaters operating at a sheath temperature of 1500 F. Processed aluminum reflectors provide optical control of the radiant energy. Installation is entirely of non-fragile construction.

Switches are provided to control the heat in zones as required for handling ordinance equipment such as tanks, coast artillery rifles, half-tracks and other vehicles. Adjustable reversing controls are provided so that the unit may be made to oscillate back and forth over any desired section of the track.



Jensen Specialties, Inc.

PAINT BAKING is speeded by mobile type radiant infrared oven which heats products too heavy or bulky for normal handling on dollies or conveyors

POWER FAILURE PREVENTED!

—Thanks to the split-second action of a BLAW-KNOX FOG SYSTEM

A transformer fire, no matter how small, can disrupt the 24-hour service now taken for granted of utilities. And, while financially unimportant, it may easily cause a blackout affecting defense industries, hospitals, homes and municipal properties. Don't you think it is your obligation to protect both your own property and customer good-will with the most efficient system for transformer protection?

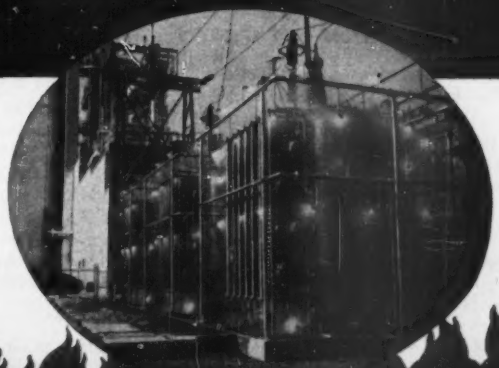
At your request a Blaw-Knox Engineer will survey your fire hazards, prepare a preliminary layout of the system that will give you the utmost in fire protection, and submit an estimate of costs—all without obligation.

BLAW-KNOX CONSTRUCTION COMPANY
BLAW-KNOX SPRINKLER DIVISION
829 Beaver Ave., N.S., Pittsburgh 33, Pa.

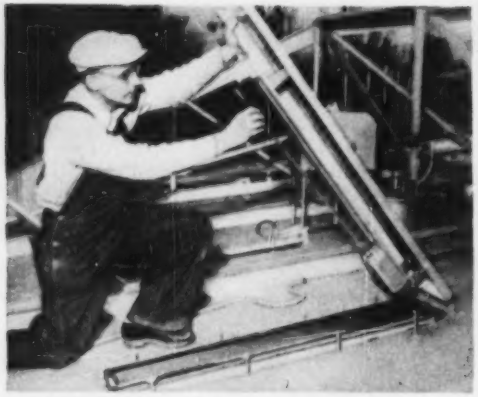
• • •

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

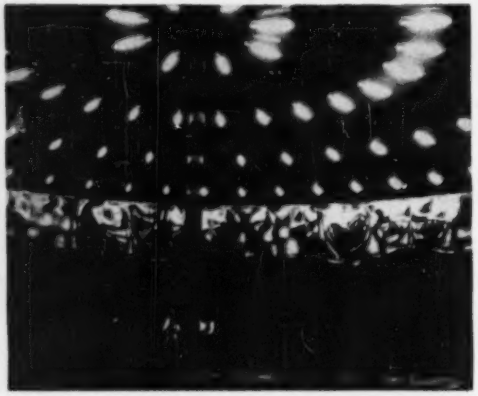
"LITTLE JOEY SPRINKLER"
Always on the Job



BLAW-KNOX



EASY REPLACEMENT type fixture speeds relamping and servicing of each of the 112 lamps installed



GERMICIDAL LAMPS installed in million-gallon sugar storage tank prevent spoilage or fermentation on surface of liquid sugar

Ultraviolet Lamps Keep Liquid Sugar Sterile

Liquid sugar in two 1,000,000-gal storage tanks of the California and Hawaiian Sugar Refining Corp., Crockett, Calif., is kept sterile with installation of ultraviolet germicidal lamps. The dome of each 95-ft diameter tank is fitted with 112 of the lamps, mounted in four concentric circles.

Only surface sterilization is necessary—the density of the syrup inhibits the action of any air-borne organisms in the body of the product.

The 30-w lamps are installed on eight circuits in C&H-built fixtures designed for simple replacement. Ultraviolet light meter tests are made periodically to discover when replacement is necessary.

INDUSTRIAL BRIEFS

Wood gluing of scrap flooring at The Inlaid Floor Co., Emeryville, Cal., with 10-kw electronic gluer, turned a liability into an asset. Scrap ends of oak flooring boards had to be hauled to the dump and burned at a monthly cost of $200. The electronic gluer enables them to produce a product that is in great demand by builders because it is less expensive than the equivalent in regular flooring stock. G. E. Hersam, Industrial Power Eng., Pacific Gas and Electric Co., Oakland, Cal.

Heating oil at Great Lakes Carbon Corporation, Chicago, Ill., with dual electric heaters and pumps raises fuel oil to pumping and kindling temperatures. Safety devices incorporated within equipment prevent carbonizing of oil and fire hazard. Twenty-four hour per day operation has high load factor and unity power factor. Entire investment will liquidate itself within 2 yr. This equipment, which replaced several steam boilers formerly used to preheat No. 6 Bunker "C" oil, consists of two 24-kw inner tank heaters, one 6-kw suction heater, one 4½-kw pipe line heater and two 100-kw booster heaters, complete with fuel pumps and automatic control. V. D. Titzel and A. C. Jorgenson, Commonwealth Edison Co., Chicago.

Enamel baking at F. J. Cooper & Son, Attleboro, Mass., with a completely conveyorized 10-kw, 110-v, single phase furnace enables the manufacturer to vary production speed and to maintain 1400 F. Each piece of ceramic enameled jewelry ornaments and fraternal jewelry is an exact duplicate of the one that went before and—no discolored enamel. George B. Newton, Power Sales Eng., Attleboro Steam and Electric Co., Attleboro, Mass.

Disposal of fluorescent tubes is safer at Pearl Harbor Naval Shipyard by use of a tube breaker powered by a fan motor. Tube breaker is self cleaning—eliminating chance of cuts and scratches. Tubes are fed into breaker where weights attached to motor shaft pulverize glass. Four sprinkler nozzles settle phosphorus and flush refuse from tube breaker's conical bottom into a steel drum. About 230 4-ft tubes fill a 55-gal drum. Filled drums are sealed and burned.

Cabinet Drying Time Reduced 300%

Drying paint on kitchen cabinets at Precisionware, Inc, of Millerstown, Pa., with 22 kw of electric heaters in a new paint-drying tunnel has cut drying time over 300%. Heaters are thermostatically controlled and supplement a forced hot air system to maintain even temperature throughout tunnel. Prior to installation of this drying tunnel, cabinets were air-dried and could not be packaged for 8 to 10 hr after painting. In the new drying operation product is conveyed to attic of plant, then passed through drying tunnel and back to second floor, completing drying cycle in 2 hr. Cabinets are more thoroughly dried than formerly and can be packaged without danger of damaging finish. Space previously used for air drying has been changed over to assembly work—further increasing production. Wm. F. Owens, Ind. Rep., Pennsylvania Power & Light Co, Harrisburg, Pa.

PENNSYLVANIA TRANSFORMERS

an important component of many

"Selected" Outdoor Substations

There is only one positive way of combining the finest equipment into an outdoor substation, and that is by careful selection of all component parts.

Only by carefully selecting transformers, switchgear, breakers, etc., can the engineers of an Electric Utility be sure that all items of the station will meet the prescribed mechanical and electrical requirements. And *only* by selective ordering can the Utility get what it actually *wants* and *needs*.

Pennsylvania transformers are an important component in many outstanding outdoor substations. The Midway Station of the Cincinnati Gas & Electric Company is an example of a modern substation in which the component transformers were supplied by Pennsylvania Transformer Company.

•

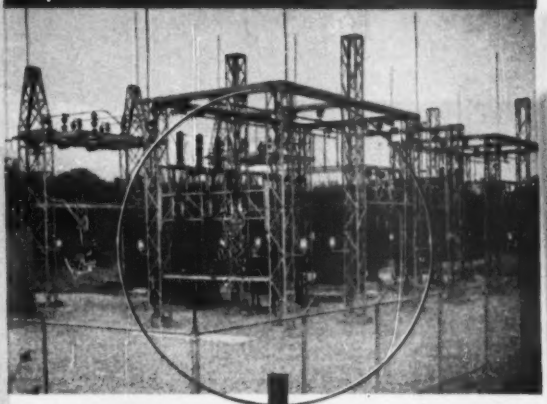
"Pennsylvania Power Transformers are available in sizes up to 200,000 Kva, and voltages up to 230 Kv. Transformers with ratings of 70,000, 100,000 and 120,000 Kva are now under construction in the Pennsylvania plant."

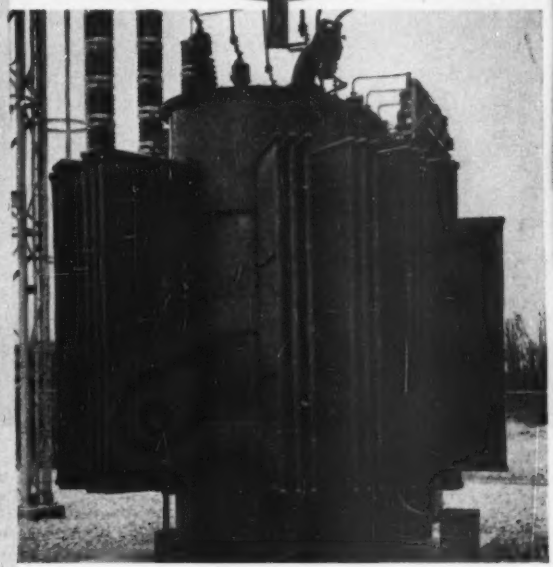
NOTICE TO ELECTRIC UTILITIES

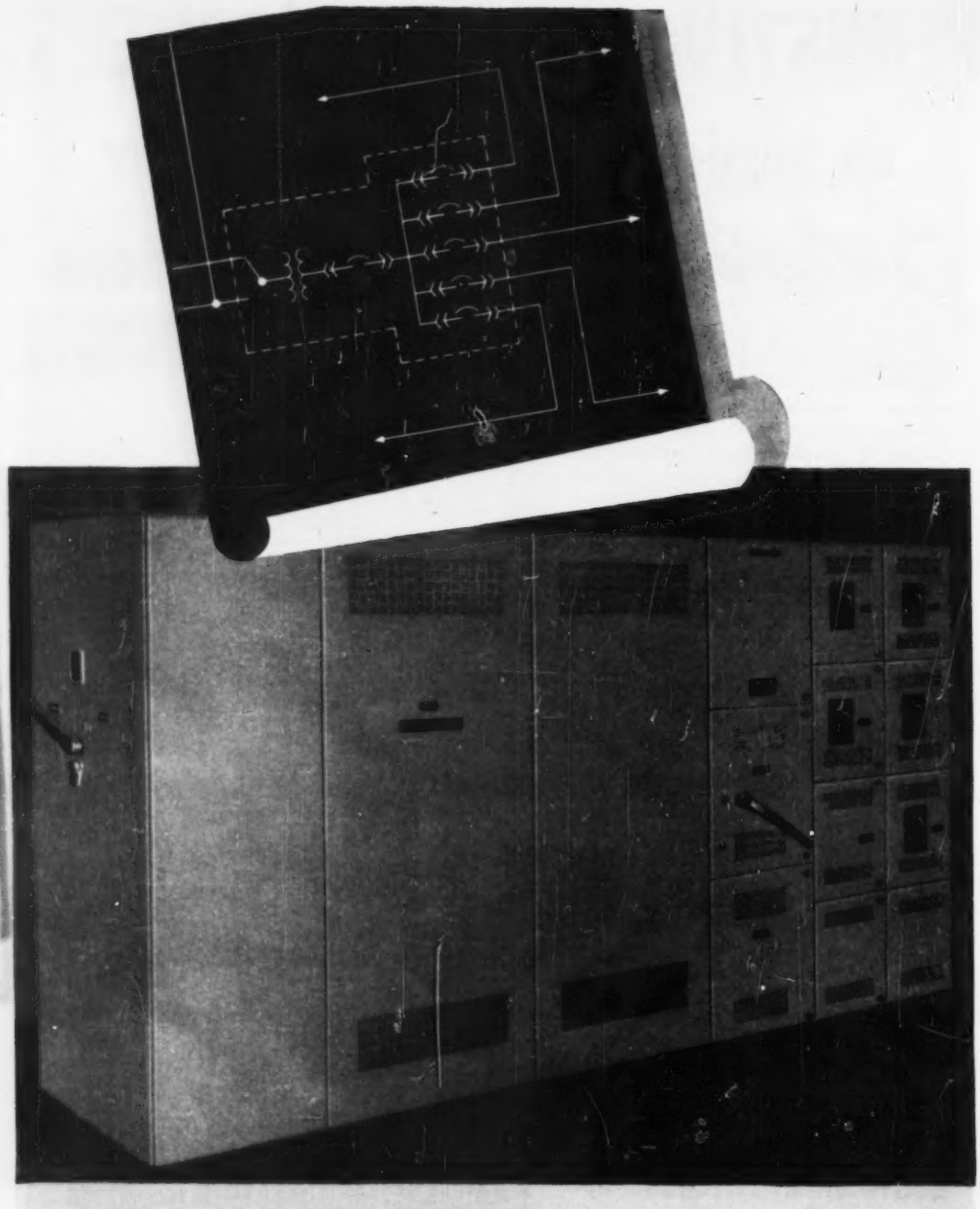
You are invited to inspect the plant and facilities of Pennsylvania Transformer Company. Arrangements can be made through a Pennsylvania sales representative, or by contacting Pennsylvania's Sales Department, 529 Adams Avenue, Canonsburg, Pa.

Pennsylvania
TRANSFORMER COMPANY
CANONSBURG, PENNA.
Greater Pittsburgh District

MIDWAY SUBSTATION







This complete factory-assembled Westinghouse Dry-Type Power Center cuts power distribution costs at General Metals, Vernon, California plant. The dry-type transformer eliminates fire hazard . . . the need for vaults . . . the expense of storing, filtering or replacing oil.

Here's how General Metals Corporation solved a load growth problem . . .

Economically!

A load growth problem at General Metals Corp. necessitated a switch to high-voltage distribution. To meet the growing load requirements, they selected a Westinghouse Power Center to serve a primary selective radial system. Note how they credit the power center for a big part of the savings.

> *"Initial savings resulted from simplified installation of the Power Center, and the use of shorter secondaries. Currently, improved voltage conditions and reduced line losses produce a saving in terms of more production output per kwhr used. And the unit's low maintenance and flexibility characteristics lead us to expect a similar return in the future."*

Westinghouse Power Centers offer *you* this same modern, low-cost way of attaining peak efficiency in your plant's power system. And they're available in types to suit the specific requirements of your operation. J-60772

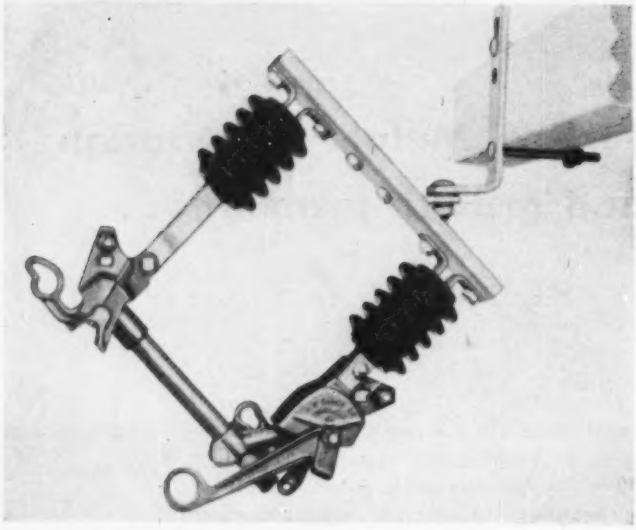
GET THE COMPLETE STORY! Booklet B-4162 covers Westinghouse Power Centers in detail. Booklet B-4045 discusses various types of plant distribution systems wherein power centers offer maximum advantage. For your copies contact your Westinghouse Representative or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

YOU CAN BE SURE... IF IT'S

Westinghouse

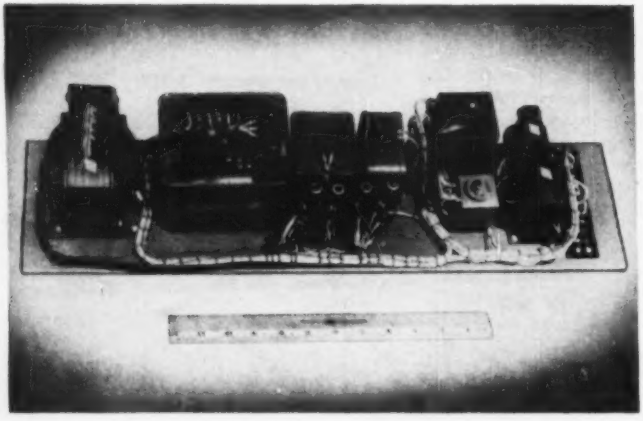
POWER CENTERS

NEW EQUIPMENT



Double-Insulator Cutout

Furnished with insulators to meet NEMA cutout standards or 3-in. bolt circle NEMA insulators. Kick-out action is mechanically time-delayed, arc extinguished in tube before contacts separate. Can be used as manual interrupter.
A. B. Chance Co, Centralia, Mo.



Magnetic Amplifiers

Low cost devices for precision control and amplification of ac. Claimed highly efficient, durable, shock-proof, heat and humidity proof. Engineered to operate from any single or polyphase ac supply, at voltages up to several hundred and frequencies to Mcs. Amplifications to 1,000,000 X are possible. Designed for motor speed controls, voltage regulation, amplification of thermocouple or strain gage signals, etc.
Karl-Douglas Assoc, Hawthorne, Calif.

Insulating Tape

Self-bonding electrical tape designated Bi-Seal Type V claimed dielectric strength over 1,000 v/mil, high tensile and abrasion strength, corrosion and weather proof. Polyethylene compound fuses into solid mass when applied. Suited for temperatures to −40 F, available ½, ¾, 1-in. wide, 0.020-in. thick, 30-ft rolls.
Bishop Manufacturing Corp, Cedar Grove, N. J.

Slasher Drive

Packaged unit uses magnetic amplifier control of yarn tension in slasher process. Operated by push buttons, speed-setting rheostat. Dc generator and drive motors excited from selenium-type rectifiers. Lint-tight cabinet 76x42x25 in.
Westinghouse Electric Corp, Pittsburgh 30, Pa.

Radiation Pyrometer

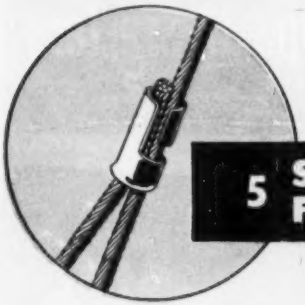
The small-target high-speed Rayotube is mounted four in. from the induction coil, focuses on small opening between turns. Its housing can stand to 350F, while temperatures from 800F up can be measured and, through an electronic recorder, indicated and recorded.

After sudden exposure to radiation, the tube is claimed to indicate 99% true temperature within 0.6 sec, lags changing temperature only 0.15 sec. Optical system is hermetically sealed.
Leeds & Northrup Co, Philadelphia, Pa.

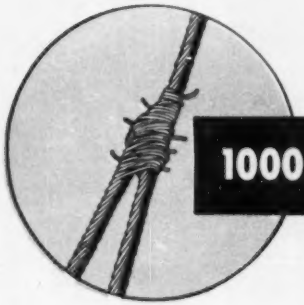
Meter Protection

Against corrosion from extreme atmospheric conditions. All aluminum, copper alloy, and ferrous parts of watthour meters are treated with suitable finishes. Treated parts have been tested successfully under salt spray conditions defined in ASTM Spec B117-49T. Functional parts are claimed practically unaffected by this highly corrosive exposure.
Sangamo Electric Co, Springfield, Ill.

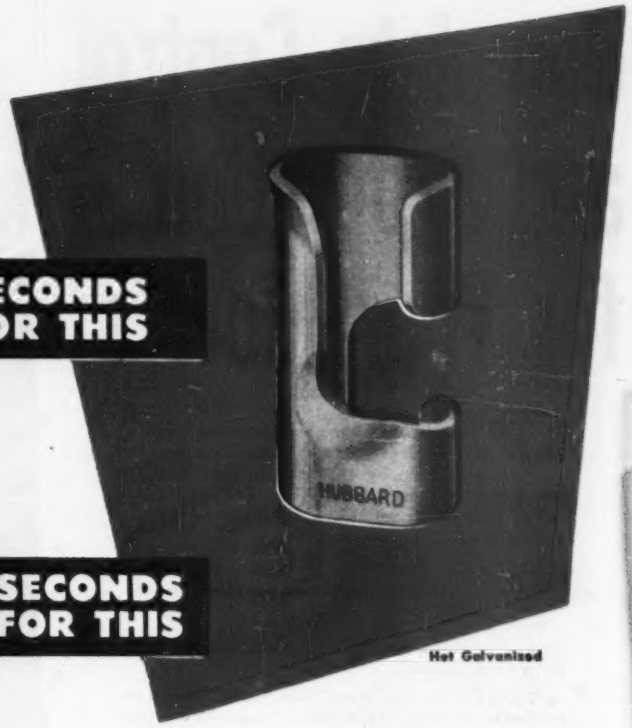
WHICH?



5 SECONDS FOR THIS



1000 SECONDS FOR THIS



Hot Galvanized

Write

FOR THESE SAMPLES...

or, look in your next shipment of Hubbard Guy Clamps for an envelope containing several ServiSleev samples. Try them . . . see how perfectly simple and simply perfect they are.

SERVISLEEVS
Make the Difference!

The cost of servicing a guy wire by wire wrapping is many times the cost of a ServiSleev . . . and the result is an awkward, bungling, unsightly job, dangerous to the lineman while installing, and forever afterwards.

ServiSleevs are applied in less time than it will take you to read the next sentence. Slip the ServiSleev over the guy wire, belled end toward the clamp; tap it with a wrench or pliers, and you have a neat, safe, and permanent installation.

Millions of ServiSleevs are in use throughout the world. They have made the wrapping of loose guy wire ends as obsolete as surreys and high button shoes.

HUBBARD AND COMPANY

PITTSBURGH • CHICAGO • OAKLAND CALIFORNIA

"Hang the load on Hubbard Hardware!"

Complete Control and Protection for Your Motors

Type H Starters

ONE ATTRACTIVE easy-to-install steel cabinet is all you need between line and motor when you specify Allis-Chalmers Type H Starters. Contactors, protective devices, meters, relays . . . everything you need for complete control and protection of your motors is built into Type H Starters. You get:

1 **Short Circuit Protection . . . provided by current limiting fuses that are easily accessible.**

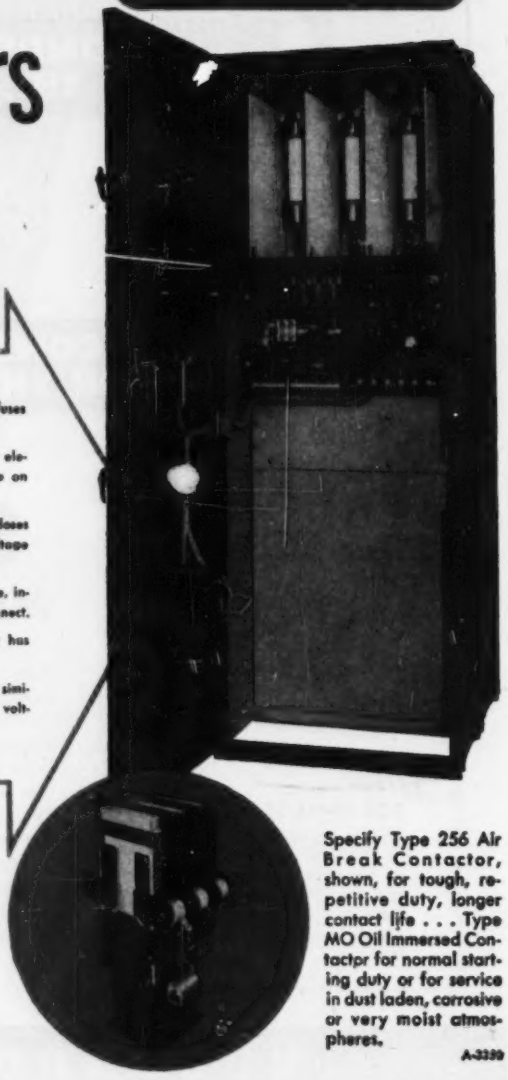
2 **Overload Protection . . . Thermal relays have compensating elements — automatically adjust for ambient temperatures — trip on motor overload only.**

3 **Safe, Accessible Cubicle . . . upper front compartment encloses disconnect type fuses; lower front compartment, the low voltage control devices; rear compartment, the high voltage equipment.**

4 **Easy Installation . . . single steel enclosure is easy to handle, internal wiring is complete, wiring terminals accessible, easy to connect.**

5 **Personnel Protection . . . high voltage fuse compartment has electrical interlock.**

6 **Meters, Push Buttons, Recording Instruments, Rheostats, and similar devices you may need are mounted on the door of the low voltage compartment.**



Other features include undervoltage protection . . . and your choice of either air break or oil immersed contactors — whichever is best for your application.

For motor control that is engineered to your job, specify Allis-Chalmers Type H Starters for motors with ratings up to 2500 hp. Call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 14B6410A.

Specify Type 256 Air Break Contactor, shown, for tough, repetitive duty, longer contact life . . . Type MO Oil Immersed Contactor for normal starting duty or for service in dust laden, corrosive or very moist atmospheres.

A-3330

ALLIS-CHALMERS

Micro-Talkie

Transmitter designed for 152-174 Mc range, weighs 1 lb 3 oz, has power output 20-40 mws, optimum range five mi. Dimensions 7⅜ x 2½ x 1¾. Uses eight sub-miniature tubes with "printed" associated circuiting. Normal operation gives A battery life of one work week, B battery life 2½ wks.

Motorola Comm & Electronics Div, Chicago 51, Ill.

Aluminum Welding Alloy

Called Chemalloy, material can be used to tin aluminum which can then be soft soldered. Also serves to combine zinc, bronze-copper, lead, tin, silver without explosive reaction.

Sightmaster Corp, New Rochelle, N. Y.

Flat-Sided Conduit

For concrete-encased underground power and communications circuits, permitting accurate build-up without spacers. Non-metallic, inorganic composition, smooth bore. Chemically inert, said unaffected by water, fire, temperature changes, corrosive atmosphere.

Soapstone Duct Co, Menlo Park, Calif.

Gearmotor Cleaner

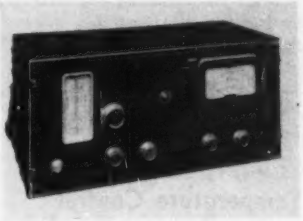
For cleaning fully assembled motors by submersion, running while submerged, drying with compressed air. Claimed not to affect winding or insulation.

The Shaler Co, Waupun, Wis.

Variable Transformer

For portable use, primary is 117 v a c, 50 w; secondary continuously variable 7 to 13 v, four amp. continuous duty. Weight three lbs, measures 3½ x 4 x 3½. Said to be mechanically rugged, stand high temperatures.

Pacific Transducer Corp, Los Angeles 64, Calif.



Modulation Monitor

To check modulation swing of FM transmitters in bands 25 to 174 mc. Coverage acquired through two bands. Modulation swing is indicated directly on 4-in. panel meter with a 20-kc full scale linear calibration. Measures 9 x 20½ x 12 in., weighs 35 lb.

Browning Laboratories Inc, Winchester, Mass.

Current Transformer

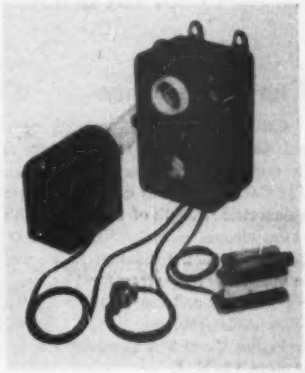
800-amp unit added to indoor-outdoor butyl-molded transformers. New unit has 150% continuous rating, is applicable to single or three phase circuits.

General Electric Co, Schenectady, N. Y.

Servo Tester

For field maintenance. Transient response shows on 3-in. cathode ray tube, servo is adjusted to equalize loops. If this is not possible, the loop is inoperative. Operates from 117v, 60 or 400 cps.

Industrial Control Co, Wyandoch, N. Y.



Photoelectric Counter

Completely packaged, designed for remote counting. Input 115v ac; output 50v-amp noninductive 115v 60 cps. Counts to 600 units per minute. Special lights available for longer range.

Photoswitch Inc, Cambridge, Mass.

Tubing Support

Prefabricated steel parts for supporting instrument tubing. Continuous support, easy assembly, fittings for direction and elevation changes. Sections of flattened expanded steel trough, ¾ in. diamond 11 gage. Available 1½-in. high, width 3 to 24 in.

T. F. Cope Inc, Philadelphia, Pa.

Plastic Fuse-Puller

Made of transparent amber Tenite. One end handles fuses to 30 amp, other end fuses 31 to 100 amp. Tests claim over 4,000v breakdown after 24 hr immersion in salt water, double strength of fibre pullers. Weight 2 oz.
Star Fuse Co, New York 13, N. Y.

Class B Insulation

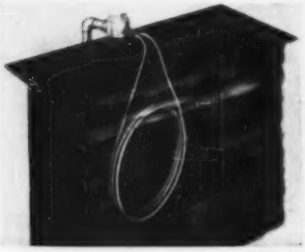
Called Irv-O-Bestos, consists of a polyster film bonded to asbestos papers in duplex and triplex combinations. The 0.003 in. duplex construction has a dielectric strength of 1,900 vpm with ¼-in. electrodes and 1,500 vpm with 2-in. electrodes. Insulation may serve in motors, dry-type transformers, magnet wire and coil insulation, or as primary cable insulation.
Irvington Varnish & Insulator Co, Irvington 11, N. J.

Soldering Unit

Utilizing resistance or conduction principle. Selector knob for 24 degrees of heat from 450w to 80w; 25w standby. Input 115v 60 cps. Unit supplies and regulates current required for heat selected.
Wasserlein Mfg. Co, Joliet, Ill.

Non-Toxic Solvent

For cleaning electrical motors and equipment. Called Formula 602, the solvent degreases instantly, dries quickly without leaving residue and is noncorrosive to metals, makers claim. Test with white rats showed repeated exposure to 602 was not fatal; while carbon tetrachloride was.
The Penetone Company, Tenafly, N. J.



Immersion Heater

For electroplating baths has lead sheath to resist corrosive acid action of copper, chrome, and nickel solutions. Rated 5 kw on 230v, heater is 3x16x27 in. Terminals are protected by moisture-tight cast iron housing. Separate thermostatic control is possible.
Edwin L. Wiegand Co, Pittsburgh 8, Pa.

Temperature Control

Package system contains temperature primary element transmitter, controller, recorder, manual control, power relay, one or more constant voltage transformers. Claimed instantaneous accurate response, unrestricted location of units, interchangeability of components without recalibration.
Swartout Co, Cleveland, Ohio

Magnetic Amplifiers

Series of fine designs in stock, to suit various specific requirements. Class A insulation. Input 115v 400 cps single phase, output 10w reversible phase. Measures 4x3½x2½ in., weight 13 oz.
Keystone Products Co, Union City, N. J.

Contact Controller

For solenoid valves, warning signals and motors. Vapor actuated, designed to stand fairly heavy electrical loads. Red and green pilots show position of switch. Operates on 115 v a c, obtainable for voltages to 250 v a c.
A. O. Trerice Co, Detroit 16, Mich.

Protective Tape

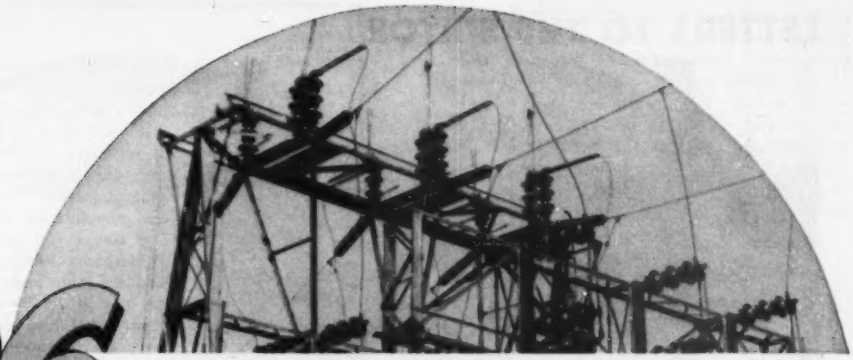
Made of polyethylene, claimed to have high electrolytic corrosion resistance, low moisture vapor transmission, good temperature range 0.012 in. thick, 100 ft rolls, 1 to 8 in. wide. Sold per case.
Polyken Industrial Tape, Chicago 6, Ill.

MORE NEW PRODUCTS
about which you should know

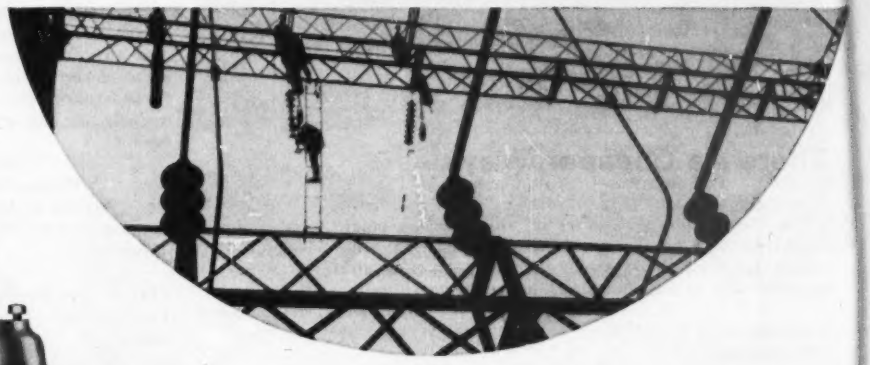
Dee Electric Co, Chicago 22, Ill, has a **solder pot** for soldering heavy units such as motor commutators. Available 4 in. sq x 2 in. deep to 6 in. sq x 5½ in. deep. Temperatures 450-750 F to 600-1000 F. Voltage 110ac, 600 to 1,300w. . . . Garden City Plating & Mfg Co, Chicago, Ill, has a series of fluorescent **ceiling fixtures** of general-diffuse type, 50% direct and 50% indirect light distribution. 2 and 4-lamp units for standard or slimline.

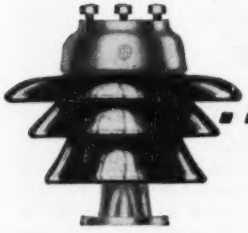
Rapid Electroplating Process Inc, Chicago, Ill, offers **high speed silver** applied by 6-v. applicator, said to give highest electrical and thermal conductivity known. . . Industrial Products Co, Philadelphia, Pa., has an **anti-fog liquid** for glass and plastic surfaces that cleans and treats in one application, contains no alcohol or glycerine.

Minneapolis-Honeywell Regulator Co, Freeport, Ill., has **snap-action switches** operating with forces down to ½ oz. Flat lever actuators. Available 15 amp 125/250/460 vac, ½ amp 125 v dc, ¼ amp 250v dc . . . Lenk Mfg. Co, Boston, Mass, has a pencil-type electric **soldering iron** in 25 and 40w sizes. Tip ⅛-in. dia, length 7½ in.



26 YEARS APART
on the same system





. . . both insulated with O-B

In the same Midwestern industrial city these two major stations were equipped completely with O-B switch and bus insulators, *26 years but only a few miles apart!* In the intervening time, many others on the same system have been so-constructed. Records on all these stations are available in power company files. With 26 years of facts available--facts collected on that company's own terms--engineers again chose O-B.

How can you be sure your choice of switch and bus insulators, today, will stand every test of time and experience for the next 20 or 30 years? The men who built the stations shown here know the answer. Check the records--the older the better--and then do the logical thing. Specify O-B.

Ohio Brass
MANSFIELD OHIO, U.S.A.

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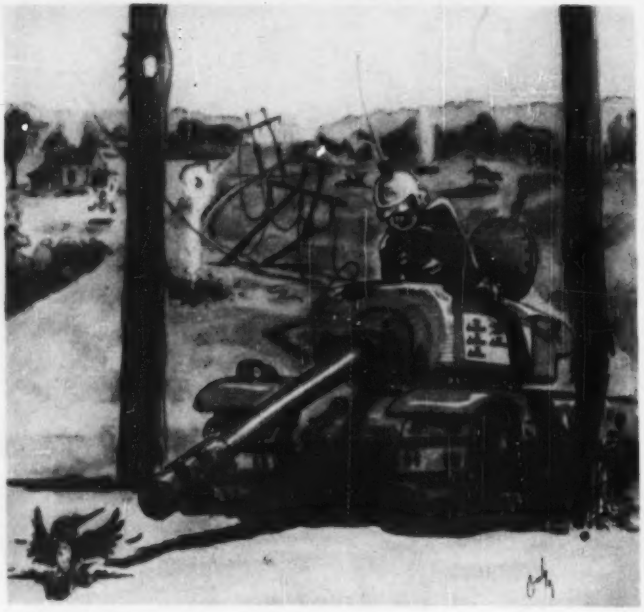
LETTERS TO THE EDITOR



There's a Cheaper Way

To the Editor:

The above action shot shows to what extremes utilities in the Middle South area have been driven by ferocious, pole-destroying woodpeckers. I believe Electrical World should run an engineering article on some less expensive way to lick the feathery menace.

W. L. Rush, T&D Engineer

Louisiana Power & Light Co
142 Delaronde Street
New Orleans 14, La.

• We can take a hint. We'll publish your story telling how you licked the woodpeckers with hardware cloth as soon as possible.

A Bit More on Connectors

To the Editor:

In the letter published in the Nov. 10 issue (Page 34), the Electrical Service Connector Institute focused attention on what we believe is the major practical aspect of the aluminum to copper connection problem. Obviously, the possibility of galvanic corrosion between aluminum and copper would be removed or greatly reduced if the two metals can be physically separated as with the insulating washers illustrated in the drawings of the European connectors. Just as obviously, the cost of the European type of connector would be extremely high when compared to the cost of copper to copper connectors in conventional use in this country.

Perhaps a major factor that influences the different approach to this problem by American and European engineers is the relative cost of labor and materials in the two areas. In Europe materials costs in terms of American dollars are likely to be fairly close to costs in America, perhaps somewhat higher, while labor costs are likely to be only ⅛, ¼, or ½ as much. As we see it, the essence of the problem in this country is the determination of adequate designs of connectors and techniques for their application that will result in installed costs being low enough so as not to interfere seriously with the economic advantage enjoyed by aluminum.

Consideration of all the factors involved, of which galvanic corrosion is only one, must necessarily be incorporated into a connector design by the manufacturer of the connector. Our company is not a manufacturer of electrical connectors, and we have no plans at the present time for entering this field. We do not take the position that these problems can necessarily best be solved by the primary aluminum producers nor that they are necessarily the most competent to pass judgment.

It is reasonable to expect that a better solution to any problem will be found when as many people as possible are actively seeking the answer. We solicit the continued efforts by members of the institute toward the improvement in commercially practical ways of designs of connectors for aluminum conductors for use under all types of service conditions, and we offer our fullest cooperation to them.

Harold W. Adams
Product Supervisor, Cable
Products & Applications Dept.
Reynolds Metals Co
Richmond, Va.

• Let us hope the connector problem is soon solved.

Credit Where Due

To the Editor:

It was not in New Hartford but in West Hartford, Conn., that, as related on page 39 of Electrical World, October 27th, the school feeding program was streamlined by installation of a predominantly electric kitchen.

We have only the best of feeling for New Hartford and for the Connecticut Power Co which serves that community. But since The Hartford Electric Light Co was largely concerned in this particular job, we would like to point out that it (West Hartford) is in our service area so that we will not be deprived of such credit as may accrue from this activity.

E. D. P. Gross
Commercial Power Consultant
The Hartford Electric Light Co
Hartford 15, Conn.

C-O-TWO

FIRE EXTINGUISHERS

give fast, positive fire protection

● Top quality backed by experienced engineering results in operating superiority at all times with the world famous C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers as well as the newer C-O-TWO Dry Chemical Type Fire Extinguishers. Furthermore, modern manufacturing facilities and extensive field testing, together with approvals such as the Underwriters' Laboratories, Inc., Factory Mutual Laboratories and Government Bureaus assure you of fast, positive action the instant fire strikes.

CARBON DIOXIDE TYPE

With C-O-TWO Squeez-Grip Carbon Dioxide Type Fire Extinguishers the penetrating carbon dioxide is a clean, dry, non-damaging, non-conducting inert gas . . . smothers fire in seconds, leaves no after fire mess . . . highly effective on flammable liquid and electrical fires, as well as some surface fires involving ordinary combustible materials. The C-O-TWO Squeez-Grip Valve is the greatest single contribution to the releasing of carbon dioxide for first aid fire fighting . . . just squeeze lever to open . . . release to close.

Convenient 2½, 5, 10, 15 and 20 pound hand sizes . . . discharge horn non-conducting, shatterproof construction. Also, convenient 50, 75 and 100 pound wheeled sizes . . . available with sturdy, wide-faced wheels either with or without rubber tires, as well as available with or without discharge hose and horn protection cover.

DRY CHEMICAL TYPE

With C-O-TWO Dry Chemical Type Fire Extinguishers the heat-shielding dry chemical is a non-conducting, non-abrasive, non-toxic, finely pulverized powder compound . . . blankets fire instantly . . . exceedingly effective on flammable liquid, gas and electrical fires, as well as surface fires involving ordinary combustible materials. The exclusive inverting design renders constant free flowing dry chemical, assuring faster, more effective and complete discharge.

Convenient 4, 20 and 30 pound hand sizes . . . no syphon tubes or valves within the cylinder to become clogged or inoperative . . . discharge hose and squeeze type discharge nozzle remain empty until actuation takes place . . . one piece removable top assembly. Also, convenient 150 pound wheeled size . . . sturdy, wide-faced wheels . . . discharge hose and two position discharge nozzle having soft or solid stream fully enclosed in protection casing . . . footrail and dual bar handle provide easy inverting.

Act now for complete free information on these fast, positive fire extinguishers. Remember fire doesn't wait . . . get the facts today!

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Squeez-Grip Carbon Dioxide Type Fire Extinguishers
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CUT TIME and COSTS..

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EXTERNALLY OPERATED TAP CHANGER

just a TWIST of the WRIST CHANGES TAPS

Yes, with RT&E's externally operated tap changer, taps are changed with a twist of the wrist in a matter of seconds — externally mounted, not only to avoid opening unit to observe or change taps, but to eliminate the dangers of oil contamination from moisture and dirt. RT&E's externally operated tap changer has been exclusively used for over 2 years of trouble-free field service. Standard on all our KVA sizes.

Save time, costs and loss of distribution transformers by specifying RT&E.

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WHAT THEY'RE SAYING

At Industry's Meetings

Competent Engineers Needed

REGINALD J. S. PIGOTT, president of the American Society of Mechanical Engineers before the President's luncheon of the 73rd annual meeting at New York.

Policies in many engineering operations of the Government are not being made by competent engineers with competent data. Expense and confusion could be avoided by correcting the overlapping of such powerful government agencies as Rural Electrification, Reclamation, Army Engineers, and Power Authorities. Participation in research projects which help set national and even international standards in many fields, was suggested for engineers in the American Society of Mechanical Engineers.

Growth of Fluorescent Lighting

RICHARD F. TOWNSEND, commercial engineer, Westinghouse Electric Corporation before the Illuminating Engineering Society at Omaha, Nebr.

Operating fluorescent lamps now costs only one-tenth of what it did when fluorescent lighting was introduced in the United States 14 years ago. The same concentrated research and development that established fluorescent illumination as the world's most economical source of artificial white light has also accounted for a 900 per cent growth in the variety of lighting available now to fluorescent users and there are nine times as many standard sizes and types of fluorescent lamps as there were when fluorescent lighting was originally put to work in 1938.

In 1938, there were only three sizes of fluorescent tubes. Today there are 27. During the same period, seven different tints of white were developed in the fluorescent line. Today's annual lighting costs in a fluorescent installation are approximately 10 per cent of an installation producing the same amount of light when fluorescent lighting was first introduced. As a result, fluorescent lighting will account for more than half of all the artificial lighting produced in the United States this year. Numerically, the volume of incandescent lamps produced will be greater by the end of the year. But with fluorescent lamps enduring more than seven times as long and supplying three times as much light per watt, fluorescents for the first time this year will account for more than 50 per cent of the illumination produced by the nation's lamp factories.

Rebirth of a Salesman

K. P. RENDFLEISCH, vice president of sales United States Steel, Supply Division Chicago before the Purchasing Agents Association of Syracuse and Central New York Inc at Syracuse New York

I would like to take a glancing long view of our national economy and the picture may prepare you for the pleasant shock facing sellers again. Our economy today seems to me to be a multi-headed beast. I can make out at least three distinct heads which makes it a triple domed Cerberus. One of these heads is in planning our return to normal, stable market intelligently governed by the laws of supply and demand. Another head dreams of keeping us jacked up with new artificial stimulants such as strikes, wars and emergencies. Yet another head seems to have ever new plans ready for contracting and restricting the rest of the beast. I allude to our economy as a "beast" not out of a spirit of spite because I'm in love with the thing, even though it does have three heads. But I still like to be realistic and these are the conditions that prevail.

Scientific Research and Electronics

DR. ELMER W. ENGSTROM, vice president in charge, RCA Laboratories Division before the Engineers Club of Philadelphia at Philadelphia Pa.

Every new act or business based upon the technical sciences must deal continuously with the factor of obsolescence. Electrical companies, taking their cue from wartime experience, have expanded their research in industrial science due to the fact that our efforts are measured in economic results. We depend therefore to a large extent on colleges and universities and other institutions as a supply line for new basic knowledge which through applied research can be converted to practical usefulness. We direct fundamental research into those areas where we need the greatest strength.

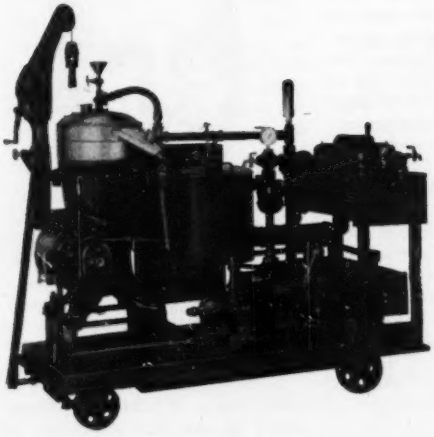
SAFE...

Low Temperature Purification

By dehydrating insulating oil at low temperatures by means of De Laval Insulating Oil Purifiers, oil is produced that is safer to use than that maintained by methods demanding relatively high heat to drive off moisture.

Low temperature purification prevents rapid reduction in dielectric strength of the oil after purification. Another advantage of low temperature purification by De Laval centrifugals is that the probability of condensate forming in the receiving tank is eliminated.

De Laval Insulating Oil Purifiers are equipped with low watt density electric heaters which prevent carbonization of the oil. Heating costs are kept to a minimum.



● *Send for Bulletin TR-1*

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THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL INSULATING OIL PURIFIERS

FREDERICK S. BLACKALL, JR

NEVIN E. FUNK

Blackall Named Head of ASME

Group's top official is president of Taft-Peirce Manufacturing Co. Nevin E. Funk is awarded society's medal

American Society of Mechanical Engineers has elected as its 1953 president Frederick S. Blackall, Jr, president and treasurer of Taft-Peirce Manufacturing Co, Woonsocket, R. I.

In addition, the society has designated Nevin E. Funk, engineering consultant and former executive vice president and director of Philadelphia Electric Co, as the recipient of the ASME medal for pioneering achievements in economic operation of interconnected power systems.

Regional VPs . . . ASME has also named the following regional vice presidents: Henry R. Kessler, manager, Republic Flow Meters Co; Paul R. Yopp, district sales manager, Babcock & Wilcox Co; Ben George Elliott, professor of mechanical engineering, University of Wisconsin; and Harry R. Pearson, personnel director, Dallas Power & Light Co. Directors-at-Large: David W. R. Morgan, vice president, Westinghouse Electric Corp; and Ralph L. Goetzenberger, vice president, Minneapolis-Honeywell Regulator Co.

Blackall joined Taft-Peirce in 1922, becoming vice president and general manager in 1929. He has served the firm as president and treasurer since 1933.

The new ASME president graduated from Yale University in 1918 with a BA degree and attended the U. S. Naval Academy Third Reserve Officers School the same year. In 1917-18 he served with the Navy as an ensign. In 1922 he received an SB degree from Massachusetts Institute of Technology. During World War II Blackall was a member of the Navy War Manpower Survey Committee, First Naval District.

Utility Veteran . . . With Philadelphia Electric for more than 40 years, Funk held various posts in the operating and engineering departments, advancing to vice president in charge of engineering in 1929. At that time he also became vice president and director of a number of the company's subsidiaries. From 1947 until he retired in 1950 to engage in consulting work, he was executive vice president and director.

Funk received an electrical engineering degree from Lehigh University in 1905 and the doctor of engineering degree in 1943. He has been active in the American Institute of Electrical Engineers, Franklin Institute, National Electric Light Association, and the Power Division of ASME's Philadelphia Section.

•

Walter E. Metzger has been named assistant superintendent of the Electricity Division for the city of Columbus, Ohio, which operates a municipal plant.

A. G. Skina, former head of the Construction Expediting Branch of Defense Electric Power Administration, has joined Commonwealth Services, Inc, New York, as a general consultant, specializing in electrical matters. Prior to World War II service with the Army Signal Corps, Skina had experience in public utility and industrial and electrical operations.

Paul R. Henson, an employee of the Rural Electrification Administration for seven years, has been named manager of Boone Electric Cooperative, Columbia, Mo. He succeeds James B. Sunderland. Henson, who resigned from REA earlier this year, was working as a management consultant when he accepted his new post.

J. R. Weaver has been appointed manager of manufacturing and engineering for the Springfield (Mass.) plant of Westinghouse Electric Corp's Appliance Division. Weaver, who has been serving on the Westinghouse headquarters manufacturing staff at Pittsburgh, succeeds **C. B. Dick,** who has been transferred to Pittsburgh, Pa.

GLENN E. SEIDEL

Minneapolis-Honeywell Appoints Seidel a VP

Glenn E. Seidel has been named a vice president of Minneapolis-Honeywell Regulator Co in charge of engineering in the company's Minneapolis plants. In his new post, Seidel will have complete responsibility over research activities and all engineering work carried on in the Minneapolis plants, other than that involving aero products.

Seidel, who has been a member of Honeywell's engineering organization

since 1943, has been director of the firm's expanding Ordnance Division for the past year and a half. Prior to that he served for a number of years as assistant to W. J. McGoldrick, who, as part of his duties as vice president, has been handling the engineering activities that Seidel assumes.

This move, according to Honeywell's Pres Harold W. Sweatt, makes it possible for McGoldrick to devote his full time to the coordination of engineering activities on a company-wide basis and to assist all sales departments in plans that look forward to the marketing of new products.

After graduating from the University of Minnesota in 1936, Seidel was football coach at Tulane University for four years. He spent a year with Coca Cola Co before joining Honeywell's engineering department.

•

A. M. Sweeney, assistant to the general manager of General Electric Co's Major Appliance Division, has retired after more than 40 years' service with GE. With the formation of the division in 1951, he was appointed to the present post. Sweeney joined GE at Cleveland in 1910 after graduation from Harvard with a BS degree in electrical engineering.

Prescott S. Bush, who was recently elected to the United States Senate from the State of Connecticut, has resigned as chairman and a member of the board of Pennsylvania Water & Power Co. **David E. Williams,** who has been a director of Pennsylvania W&P for many years, succeeds Bush as board chairman. Bush has been a director and chairman since 1941.

Guy J. Coffey, vice president of Chicago Pneumatic Tool Co, has been elected president. Coffey, with the firm since 1933, has served as vice president in charge of sales since 1945. The company also has elected **T. P. Harris** and **James F. Huvane** vice presidents and **T. F. Noonan** assistant comptroller.

Ray Pike, Jr, operating superintendent of Lowell (Mass.) Electric Light Corp, has been appointed manager of Haverhill (Mass.) Electric Co to fill the post left vacant by the retirement of **Carroll E. Haseltine.** Haseltine, who joined Haverhill in 1906, has also retired from the post of vice president, a position he has held since 1942. In

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J. Neils Lumber Company

Much of the finest transmission and telephone pole timber in the United States grows on the 200,000 acres of forest empire owned by the J. Neils Lumber Company in Western Montana. And a large percentage of this magnificent stand is Western Larch.

The larches produce straight, tall stems, the wood of which is strong, durable. Western Larch has high bending strength, high compressive strength, unusual hardness. In shock resistance, one of the most desirable characteristics in poles, Western Larch ranks the highest of the commercial softwoods.

Possessed of the qualities of long life in their original, untreated form, J. Neils literally gives Western Larch poles *double-life* through the technical processes of a modern treating plant—thus making available transmission and telephone poles of extra durability and long service.

An illustrated folder on J. Neils treated Larch poles, and information regarding their application to your requirements, will be furnished gladly on request.

***Double-Life** Western Larch Poles*

J N

J. Neils Lumber Company

Pole Division: LIBBY, MONTANA

A Big Draft Job Handled Capably by Green Fans

Twenty-four large Green Fans take care of a heavy draft load at the Venice (Illinois) Plant of the Union Electric Co. of Missouri. Each of six boilers has two sets of Green Fans, each set consisting of one induced draft fan and one forced draft fan coupled to one motor as a unit. With the heavy demands on this station, all boilers are usually in service continuously, thus throwing an unrelenting burden on the fans.

Engineers whose responsibility it is to recommend or accept draft fans for large power plants certainly want efficiency and low operating costs. But they don't overlook the maintenance and replacement angles. They want the sound designs of competent experienced fan engineers. They also want the care in construction that is found in shops of a company that has built up an international reputation as the "authority" on draft fans. They know that such a company will not tolerate sloppy shop work.

Green is this authority on mechanical draft fans.

Have You a Copy of Our Fan Bulletin No. 168? If not, we shall be glad to send you one.

THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

another appointment, **Richard W. Smith,** former superintendent of distribution for the Haverhill company and Amesbury Electric Light Co, has been designated as general superintendent of the Lowell utility. All are New England Electric System subsidiaries.

Ivan A. Patten has retired as general superintendent of the electrical department of Lynn (Mass.) Gas & Electric Co, a post he has filled since 1934. Patten, who started with Lynn G&E in 1911, will be retained by the company as a consultant. **Paul Welch** has been appointed acting general superintendent of the utility's electrical department.

OBITUARY

Max Cyril Bartlett, 61, general manager of the Knoxville (Tenn.) Utilities Board since 1939, died at Pasadena, Calif., Dec. 8. Prior to his association with the Knoxville board, Bartlett was an associate engineer for fifteen years with Burns & McDonnell Engineering Co, Kansas City, Mo.

Harold A. Scragg, 61, chairman of the Pennsylvania Public Utility Commission, died at Scranton Dec. 7. Scragg was named counsel for the PUC in 1943. He was appointed to a ten-year term in 1945 and last March was made chairman of the commission.

Paul O. Reyneau, 65, co-author of the engineering textbook "The Economics of Electrical Distribution," died Dec. 2 at Port Chester, N. Y. Reyneau, who was associated at one time with Detroit Edison Co, had been in charge of Cornell University's placement service in the New York metropolitan area since 1932.

Edgar Buckingham Holden, 82, retired electrical engineer for General Electric Co, died Dec. 13 at Westport, Conn. Starting with GE as a student trainee, he later became one of the firm's experts in the field of electric power equipment. He supervised installation of GE equipment in such projects as the hydro plant at Niagara Falls, N. Y., Muscle Shoals, Ala., and other power plants in the U. S., Canada, and Mexico. He retired in 1929 after 36 years with GE.

Dr Harvey Nathaniel Davis, 71, president emeritus of Stevens Institute of

Technology, Hoboken, N. J., died Dec. 3 at New York. Dr Davis retired in 1951 after serving 23 years as president of Stevens. His inventions included an improvement in steam turbines and processes for air liquification and rectification. He had also served as president of the American Society of Mechanical Engineers in 1938.

Leonard G. Goldsborough, 65, treasurer, assistant secretary, and a director of Canadian Niagara Power Co, died Dec. 9 at Toronto, Ont.

Samuel Everett Doane, 82, retired General Electric Co electrical engineer, died at Pine Orchard, Conn., Dec. 9. With GE since 1892, Doane was for many years chief engineer of the company's Lamp Division at Nela Park, Cleveland. During the 1920's he devoted much of his time to consultation with foreign organizations in the lighting field. He retired from GE in 1930. Doane in 1919 was elected president of the national Illuminating Engineering Society.

Gerald V. Cruise, 56, former member of the New York State Power Authority and consulting engineer for the International Monetary Fund from 1948 to 1950, died at Jackson Heights, N. Y., Dec. 9. Cruise was named executive secretary of the New York Authority in 1929 and was a member of the board from 1941 until 1950. While a consultant to the Monetary Fund, he surveyed power projects in South America and in the Far East.

James C. DeLong, 91, former head of Syracuse Lighting Co, died Dec. 10 at Syracuse. He was president of Syracuse Lighting from 1913 until his retirement in 1930. DeLong remained as board chairman of the utility until 1937 when it was merged into the Niagara Mohawk Power system. He later served as advertising director for General Cable Corp.

A. Stuart Pratt, 91, former vice president of Stone & Webster, Inc, died at West Newton, Mass., Dec. 3. Pratt, who was educated at Massachusetts Institute of Technology, had served the firm for 40 years. He also had been a vice president of Brockton Edison Co.

Kenneth A. Walz, 57, superintendent of Justin R. Whiting power station for Consumers Power Co, died recently.

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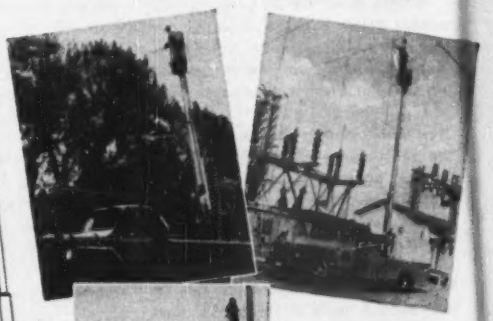

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Power Deficit Affects Alcoa . . .

. . . and the Harvey Machine Co aluminum enterprises in the kw-hungry Pacific Northwest. Supply squabble is on

The Pacific Northwest power shortage continues to plague the aluminum industry. This was made apparent when the Aluminum Co of America encountered opposition after reactivation of the second potline at its Wenatchee (Wash.) plant.

And it was made more apparent when Harvey Machine Co also became another victim of the power shortage The firm is negotiating with Klickitat County (Wash.) PUD for a possible site on the Washington side of the Columbia River for its proposed aluminum plant, but it is reported that Defense Electric Power Administration is taking a dim view of the proposed Columbia River location.

New Units Supply Power . . . With the reactivation of the second Wenatchee potline, Alcoa is faced with antagonism from other power consumers and protests from labor. Power for the second unit comes from new generators installed in Rock Island Dam. Although this reactivation is likely to antagonize other power consumers, Alcoa maintains that the new power is too far from the areas most pinched by the power curtailments to provide relief anyway.

Alcoa negotiated a contract for firm power for the second potline before the present power curtailment and, therefore, had part of the power needed at the Wenatchee plant. Remainder of the power is available through Depa's adjustment for normal industrial growth, which allows heavy power-consuming industries to adjust power base to meet planned expansion.

Reactivation of the second potline has been protested by the Tacoma (Wash.) Central Labor Council.

"Untimely" installation of the line, although providing 100 new jobs at Wenatchee, might mean the layoff of many more men at Tacoma, said Harold McIlvaigh, secretary-treasurer of the council. It would require 36,000 kw of power.

Vernie Reed, secretary of the Tacoma Building Trades Union, pointed out that 600 kwhr were needed for one man-hour of work in the aluminum industry, as compared to 200 kwhr in the metallurgical industry, less than 100 kwhr in the chemical industry, and two kwhr per man-hour in the lumber industry.

Harvey's Power . . . Harvey Machine's $45-million project, proposed for construction on either side of the Columbia River near The Dalles, Ore., would obtain power from new generation to be added during the next two years, according to E. E. Clouse, manager of the Klickitat County PUD.

Clouse said that the Bonneville Power Administration has agreed to provide Harvey with 40,000 kw still available for defense purposes, while the PUD would provide another 40,000 obtained from Bonneville under existing contracts and the priority the PUD's enjoy for publicly generated power. This would be firm power.

More than 1 million kw of firm power capacity will go on the line before the Harvey plant is scheduled for completion in 1954, Clouse figures. This includes 400,000 from McNary, 280,000 from other federal projects, and 460,000 from private and local projects.

Depa's Views . . . However, when Depa was asked recently for its views on the proposed Harvey plant, the federal agency expressed the belief that little firm power would be available in the area for the plant. On the other hand, Depa did not actually rule out the possibility that it may be feasible for an aluminum plant to be operated on an interruptible-power basis.

TVA Awards $1.9 Million in Contracts to 5 Firms

Contracts totaling more than $1.9 million have been awarded to five firms for equipment at five Tennessee Valley Authority steam plants now under construction.

Westinghouse Electric Corp re-

Win Sylvania Television Awards

Recipients of Sylvania Television Awards hold trophies at presentation dinner held recently at Hotel Pierre, New York. They are (left to right) Dan A. Kimball, Secretary of the Navy, who accepted for the service group for its television show "Victory at Sea"; Robert Montgomery, awarded for his dramatic show "Robert Montgomery Presents"; Don Mitchell, president of Sylvania Electric Products, Inc, who made the presentations; and Desi Arnaz, co-star of the television show "I Love Lucy," in which Arnaz's wife, Lucille Ball, plays the lead. The "I Love Lucy" program was selected as the top television comedy show of the year.

The awards were established in 1951 for outstanding contributions to creative television technique.

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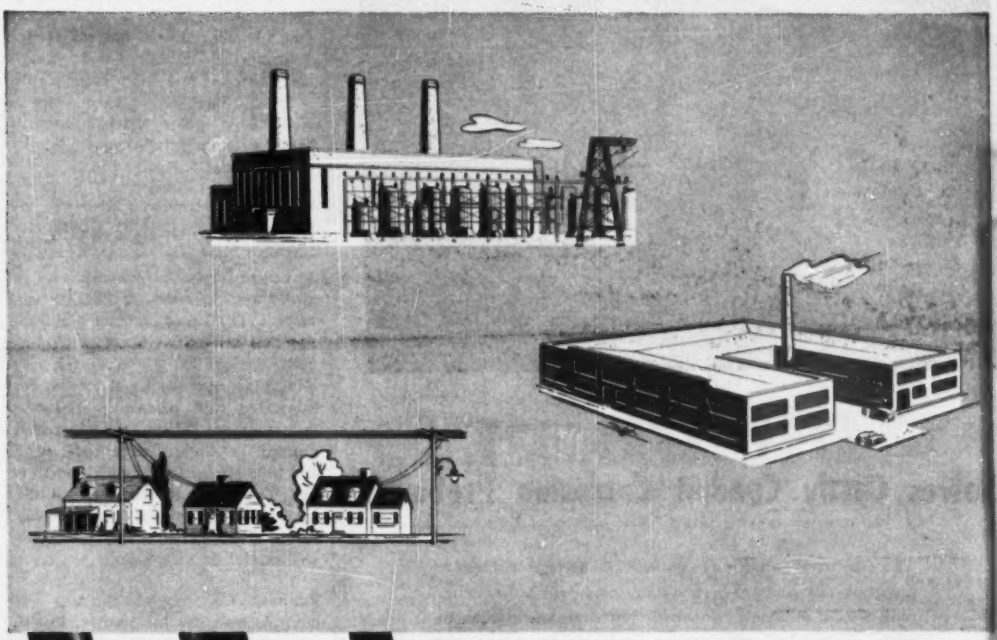

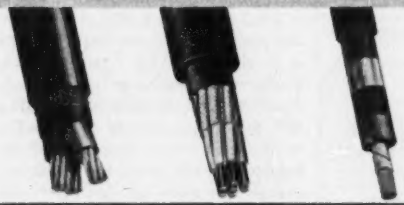

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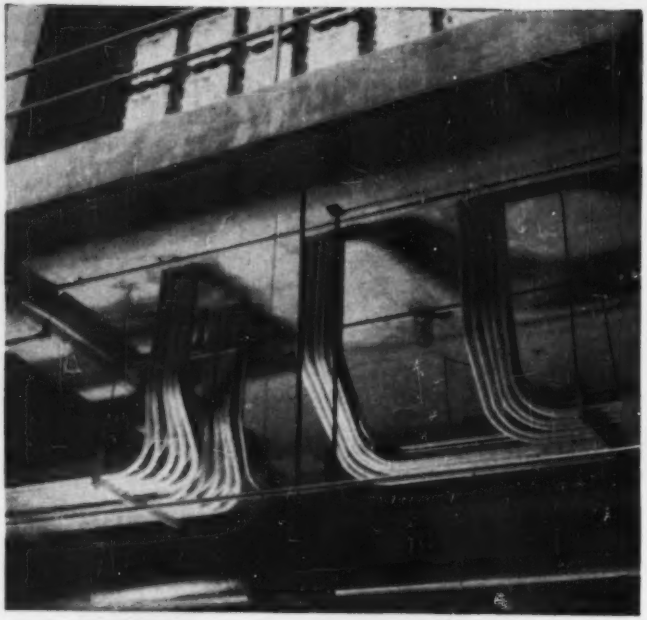

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ALCOA

ALUMINUM RIGID CONDUIT

ceived the largest one, $765,350, for forced and induced draft fans for the Kingston plant. Allis-Chalmers Manufacturing Co will furnish two condensers for the John Sevier plant at a cost of $630,000.

Lumnus Co of Honesdale, Pa., was given a $367,225 contract for closed-type feedwater heaters for the John Sevier plant. Pennsylvania Pump & Compressor Co, Easton, Pa., will supply ten station service air compressors for $96,000. These will go to the Johnsonville, Widows Creek, Kingston, Shawnee, and John Sevier plants.

Stock Equipment Co, Chagrin Falls, Ohio, got a $79,596 contract for 12 automatic coal-weighing hopper scales for the Kingston plant.

MANUFACTURING BRIEFS

In return for firmer commitments on aluminum deliveries to the government, the Office of Defense Mobilization has offered to boost producers' price ceilings by ½¢ a lb for aluminum pig and ingot and by 4% for fabricated mill products. Producers have warned that OPS increases granted in August were inadequate and would delay future aluminum output. Under current contracts with the government, aluminum producers can cancel if they fail to realize a "reasonable profit" on their sales.

Permutit Co, New York, has announced plans for the construction of a new laboratory, a pilot plant building, and extensions and improvements at its Birmingham (N. J.) works which produces ion exchange resins. Estimated to cost approximately $200,000, these new additions are expected to handle increased demands and anticipated growth in the use of ion exchange processes in industry and power plants.

SALES ASSIGNMENTS

COMPANY STAFFS

American Brass Co has appointed John N. Allen district sales manager of its newly opened district sales office located in the Merchants National Bank Bldg., Cedar Rapids, Iowa. Formerly of the company's Chicago sales staff, Allen started with American Brass in 1942.

Allis-Chalmers Manufacturing Co, Milwaukee, has named L. M. Swenson resident representative at Albuquerque, N. M. Swenson, a sales representative in A-C's El Paso branch office since 1948, came to Allis-Chalmers in 1940.

New Electrical Construction

New electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included.

UTILITIES

Proposed Construction

Arkansas—U. S. Eng., 300 Broadway, Little Rock, Bull Shoals powerhouse carrier-current equipment. Civeng 03-050-53-30.

Calif., Modesto—Charles Thieriot, 508 Roehampton Rd., San Mateo, television station, $187,000. Robert L. Hammett, 230 Bankers Investment Bldg., San Francisco, Calif., consult. engr.

Fla., St. Cloud—City, electrical system imprvs. $150,000.

Ill., Belleville—Signal Hill Telecasting Corp., Bernard T. Wilson, pres. and gen'l. mgr., 10220 W. Main St., 220,000 watt television station to broadcast on Channel 54, incl. 593 ft. antenna, studios, etc., 10220 W. Main St. $331,000.

Ind., Columbus—Public Service Co. of Indiana, Plainfield, plans by Naess & Murphy, 80 E. Jackson St., Chicago 4, Ill., 1 story warehouse, garage and office. $1,500,000.

Mich., Detroit—City, Public Lighting Comn., 174 E. Atwater St. brick, steel, concrete Mistersky Power station addn., 5425 West Jefferson St. $7,500,000, Louis J. Schrank, city engr.

Mo., St. Louis—Missouri Broadcasting Corp., L. A. Benson, pres., c/o Radio Station WIL, Hotel Chase, Kingshighway at Lindell Blvd., television station. $325,000.

Montana—Bureau Reclamation, Dpt. Interior, Billings, radio equip. for Yellowstone Dist., Fort Peck Proj. Spec. 6058-20. Extended date. L. N. McClellan, Bldg. 1A, Denver Federal Center, Denver, Colo., ch. engr.

N. J., Wrightstown—U. S. Eng., 121 N. Broad St., Phila., Pa., utilities, railroad spur, electric power facilities, McGuire Air Force Base, No. 36-109-53-181. $220,000. Extended date. Whitman, Requardt & Assocs., 1304 St. Paul St., Baltimore, Md., engrs.

N. M., Alamogordo—U. S. Eng., P.O. Box 1538, 2108 Central Ave. S.E., Albuquerque. UHF radio air/ground facilities AN/GRC-27, Holloman Air Development Center, Serial No. Eng. 29-008-53-54. Plans deposit $50.

N. C., Charlotte—Piedmont Electronics & Fixture Corp., P.O. Box 2727, television station. $690,000. Kear & Kennedy, 1320 18th St. N. W., Wash., D. C., consult. engrs.

N. C., Kinston—City, power plant addn. $1,759,000. Wm. C. Olsen, 5 Exchange Pl., Raleigh, consult. engr.

O., Toledo—U. S. Eng., 237 Fourth Ave., Huntington 18, W. Va., 69 KV sub-station and feeders. Rossford Ordnance Depot, Serial No. ENG 46-022-53-27.

Okla., Ardmore—U. S. Eng., Box 61, Tulsa, Zone 2. radio and radar shop, Inv. No. Eng 34-066-53-35. $179,000.

Pa., Pittsburgh—U. S. Eng., 121 N. Broad St., Phila., Zone 1, refrigerated storage bldg., paint, dope and oil storage bldg., Greater Pittsburgh Air Force Base, Corapolis, Inv. No. ENG 36-109-53-342. Plans deposit $10.

Tex., Amarillo—KFDA Station, 109 E. 5 St., television station. $100,000.

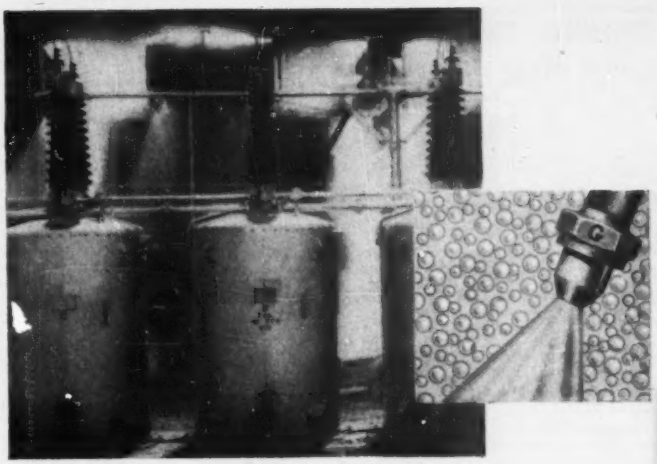
Tex., Beaumont—Television Broadcasters, Beaumont, television station. $175,000.

Vt., Montpelier—WCAX Broadcasting Corp., 135 Main St., Burlington, television station. $200,000. George E. Gautney, Warner Bldg., Wash., D. C., consult. engr.

Va., Portsmouth—P. Wks. Office, Headquarters, Fifth Naval Dist., U. S. Naval Base, Norfolk, Zone 11, modernization of power plant at U. S. Naval Hospital, NOY 70224, Spec. 30147. Plans deposit $10.

Wash., Walla Walla—Walla Walla Union Bulletin Inc., First Ave. and Poplar St., television station. $200,000. Robert M. Silliman, 1011 New Hampshire Ave., Wash., D. C., consult. engr.

Wyoming—Bureau Reclamation, Dpt. Interior, Casper, constr. 160 mi. 115-kv



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EXTINGUISHED

Complete extinguishment of fires within areas protected with Grinnell Mulsifyre sprays is usually obtained in a matter of a few seconds after the water discharge starts. Case histories prove that Mulsifyre projectors are effective wherever the danger of fire in medium or heavy oils can be limited to a definite area. In these oils the surface emulsion remains to give after-protection against flashback.

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2. Here's another instance...drizzle-wetted coal dust, streaking on an insulator, caused a flash-over which ignited an oil spill. Manual operation of a gate valve turned on the fixed Mulsifyre System, extinguishing the fire.

3. And another! Repeated operations of automatic circuit breakers due to severe electric storm caused oil spray and spillage which was ignited by flames coming from tanks through explosion vents. The explosion blew out three outside brick walls of switch room. The Mulsifyre fire protection system went into action and it extinguished the resultant fire.

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Ontario—Hydro-Electric Power Comm., University Ave., Toronto, 43 mi. power line from Glanford to Petersburg transformer station near Kitchener. Power from New Niagara Project 230,000 volts. Approx. $2,492,000.

Low Bidders & Contracts Awarded

Calif., Pasadena — Wohl-Calhoun Co., 845 N. Highland St., Los Angeles, Calif. LB, $841,136. Electronics laboratory bldg. 125 for jet propulsion lab., California Institute of Technology, ENG 04-353-53-47. U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif. Bids Dec. 5.

Mississippi—Magnolia Electric Power Assn., McComb, Miss. Own Forces. Est. $495,000. 269 mi. rural distr. lines, other imprvs., Pike Co. Bowman & Bowman, Greenwood, Miss., engrs.

N. J., Pennsgrove—Atlantic City Electric Co., Kentucky and Pacific Aves., Atlantic City, N. J., Separate Contracts. $500,000. 100x200 ft. brick, steel, concrete power plant addn., 104 ft. high. Gibbs & Hill, Inc., Pennsylvania Station, New York, N. Y., engr.

South Dakota—Hallett Constr. Co. & Continental Co., Crosby, Minn. LB, $168,695, est. $164,225. 115-kv and 230-kv transmission line approaches into Fort Randall switchyard, Missouri River Basin Proj., Spec. DC-2832. Bureau Reclamation, Dpt. Interior, Huron, S. D. Bids Dec. 4.

Tex., Florence—Southwestern Bell Telephone Co., 308 S. Akard St., Dallas, Tex., Purchases, Day Labor, $90,000, permanent type steel microwave television tower.

Tex., Midlothian—Southwestern Bell Telephone Co., 308 S. Akard St., Dallas, Tex., Purchases, Day Labor, $165,000, permanent type steel microwave television tower.

Tex., Pflugerville—Southwestern Bell Telephone Co., 308 S. Akard St., Dallas, Tex., Purchases, Day Labor, Approx. $145,000, permanent type steel microwave television tower.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ga., Chamblee—Eastman Kodak Co., 343 State St., Rochester, N. Y., plant, $2,000,000.

Ill., Chicago—Zenith Radio Corp., 6001 W. Dickens St., plans by Shaw, Metz & Dolla, 208 S. La Salle St., Zone 4, 300,000 sq. ft. factory addn. $3,000,000.

Kan., Topeka—E. E. Brunkow, 3400 Topeka Blvd., plans by Roger Frangkiser, 801½ W. 39 St., Kansas City, Mo., shopping center, 8 acres of commercial bldgs., 23 acres parking, etc., ½ mi. south on US-75, $3,500,000.

Md., Glenn Dale—Dist. of Columbia, District Bldg., Wash., D. C., 800-bed main hospital subsidiary structures, expansion of Glenn Dale Tuberculosis Sanitorium, $15,000,000.

N. Y., Brooklyn—U. S. Post Office Dept., 12 St. and Pennsylvania Ave. N. W., Wash., D. C., Brooklyn Postal Center, comprising 3 bldgs., between Atlantic Ave. and Pacific St. from Vanderbilt to Fifth Aves., $25,000,000.

Tex., Dallas—Hotel Statler Co., Inc., c/o Arthur E. Douglas, pres., 7 Ave. and 33 St., New York, N. Y., 900-room hotel, St. Paul and Commerce Sts., $15,000,000. Holabird & Root & Burgee, 180 N. Wabash St., Chicago, Ill., archts.

Tex., Houston—City, City Hall, 900 Brazos St., and Harris Co., Court House, 500-bed Psychiatric Hospital in Texas Medical Center, $5,000,000.

Tex., Houston—Houston Museum of Natural History, c/o City of Houston, City Hall, main bldg. of Museum of Natural History, $1,000,000; museum of public health, $1,500,000; planetarium, $1,500,000; science library, $1,650,000; public aquarium, $1,850,000; botanical garden, $2,500,000.

Que., Montreal—Syndicate, c/o Irving S. Backler, engr., 1250 McGill College St., 15 story office, Mayor and City Councillors Sts., $1,000,000; 15 story, concrete, structural steel, brick, stone office, Sherbrooke St. W. and Aylmer St., $1,000,000; 10 story office, Sherbrooke St., west of Guy St., $790,000.

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BOOK REVIEWS

Measuring Instruments

Electrical Measuring Instruments. **Part I. By C. V. Drysdale, A. C. Jolley and G. F. Tagg. Published by John Wiley & Sons, Inc., New York 16. 598 pages, illustrated. Price $12.**

Ever since Drysdale and Jolley produced "Electrical Measuring Instruments" in 1924 it has been a master source for instrument designers, manufacturers and users. The revision now by Tagg retains the unaltered principles and extends the treatment by recognizing the impact of new materials and new requirements. The present Part One is confined almost exclusively to indicating instruments with enough historical matter to reflect the evolution which has taken place. The reviser has striven throughout to give the reasons for things. Most of the mathematics appears with the fundamentals of theory and design that comprise the first third. The remaining two-thirds treats specific types of instruments.

Filter Design Data

Filter Design Data for Communication Engineers. **By J. H. Mole. Published by John Wiley & Sons, Inc., New York 16, N. Y. 252 pages, illustrated. Price $7.50.**

In keeping with its title this book is intended to facilitate and shorten the labor of the filter designer. Only the Zobel type is treated. Emphasis is placed on curve development rather than formula derivation and thus there is abundance of reference data for designs to meet wide requirements. The text interprets the graphical data, explains the functioning of the circuit and points out the limiting values of performance.

Employment Interviewing

The Employment Interview in Industry. **By Newell C. Kephart, associate professor of industrial psychology of Purdue University. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 36, N. Y. 277 pages. Price $4.50**

Interviews occupy a major position in the employment procedure of nearly all organizations. More than any other selection device, interviews are relied upon for hiring decisions. This book is an attempt to treat the problem of employment interviewing in the light of new developments in the field of personnel psychology. Newer techniques do not replace the interview as a selection device but rather increase its value and add to the responsibilities of the interviewer. Modern selection procedures demand that the interviewer operate less on the basis of intuition and more on the basis of knowledge and established facts. This text delineates areas where intensive study is necessary if the interviewer is to make his maximum contribution to employee selection. An extended treatment is given to such topics as: personnel testing, personnel data, physical data, and job analysis. These topics are applied to the improvement of the interview.

Electronics

Thermionic Vacuum Tubes, **sixth edition. By W. H. Aldous and Sir Edward Appleton. Published by John Wiley & Sons, Inc, New York 16. 160 pages, illustrated. Price $2.00**

This edition has been completely revised because of the many technical advances since the first edition, printed in 1931. It covers the subject of vacuum tube theory in three parts: 1. The internal action and static characteristics of tubes in terms of physical laws; 2. the application of tubes, explaining their behavior in terms of static characteristics; and 3. ultra high-frequency tubes, their properties, applications and dynamic characteristics.

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KOPPERS PRESSURE-CREOSOTED WOOD

Estimating Plant Life

(*Continued from page 73*)

ric Mean methods require a minimum amount of data for a solution, though this advantage is offset to some extent by the unreliability of estimates derived from relatively young plant. In addition estimates produced by the Geometric Mean method are difficult to gauge as to probable accuracy, and may sometimes be unpredictably erratic.

Usefulness of the Asymptotic method may increase with further research and experience.

Simulated Plant-Record Analysis . . . This approach represents a brand new technique which constitutes a major advance in the art. The only data needed are annual gross additions and annual retirements or plant balances, properly corrected. The process of analysis is one of trial and error. For the first trial, some mortality pattern is selected, say 30 years, Iowa type S_1. A table of percent survivors at all ages is prepared for this pattern. By applying these percent survivors to the gross additions, it is possible to calculate the annual balances in each year which would have resulted if the starting assumption (30 years, type S_1) obtained, and these calculated balances are then compared with the actual annual balances. By continuing this process, trying various starting assumptions as to average life and dispersion type, it can be discovered which combination best simulates, in calculated balances, the record of actual balances. Hence the term "simulated plant record." The process generally requires between 20 and 30 trials and less than seven manhours per account.

The outstanding advantage of the simulated plant record methods is that they solve for both average life and mortality dispersion type. Thus it avoids the indeterminate results of the earlier procedures, though utilizing the same source data as the turnover methods.

Dispersion of Retirements . . . A familiar parallel is frequently drawn between property life estimates and estimates of human mortality. Estimated average life of brand new utility plant corresponds to the average life expectancy of a new-born baby. One hastens to add that there is one important difference: The average life span of human beings is predictable with greater assurance.

There is also one other important resemblance. Life Insurance companies must predict not only average life, in years; they must also predict the percentage of individuals who will die at each age. In other words, it is possible and necessary to anticipate the manner in which individual deaths will be grouped around the average. Applied to physical plant, this pattern of individual retirements is known as the "type of dispersion" of retirements.

A knowledge of the type of dispersion is essential in many depreciation problems. Such convenient assumptions as FIFO ("first in, first out") may be acceptable for some inventory applications, but they are absurd and financially dangerous versions of actual retirement behavior. The FIFO convention, of course, assumes that each individual unit enjoys exactly the same average life, equivalent to assuming that every person will live exactly 65 years, no more, no less.

It is readily demonstrable that the type of dispersion may be more important than a 10-year difference in average life.

The familiar textbook explanation of "straight-line" depreciation theory also ignores dispersion and shows reserves accumulating at a straight-line rate with age. But the usual practice of "straight-line" accounting does not operate that way at all. Annual depreciation expense is ordinarily calculated by dividing the book balances by average life, and the reserve that results from this "group basis" calculation does not increase at a straight-line rate with age. This misunderstanding has caused a great dea lof unnecessary trouble and financial loss.

Iowa Type Curves . . . The report makes use of the Iowa Type Curves, but several families of curves are referred to in footnotes. The Iowa series, developed at the Iowa Engineering Experiment Station, Iowa State College, was adopted because it is the best known and most widely accepted. As an associated project, the sponsoring committee made available to member companies a voluminous set of tables, calculated from the Iowa Generalized Curves, showing the percent survivors at every age for all type curves and average lives from 7 to 60 years or more.

The Iowa Type Curves are merely a convenient means for describing the general shape of the survivor curve (i.e., the plot of percent survivors against age). It cannot be said that any particular type curve is necessarily associated with any particular class of plant. The analyst must determine what types have been approximated in the experience of his company and formulate his own conclusions.

Life Estimation . . . No attempt is made to "sell" the age-life approach to depreciation. The committee has made a determined effort to consider all angles. It has undertaken to present a scrupulously unbiased verdict on all questions where partisanship might conceivably enter.

The committee recognizes and emphasizes that life estimates are not depreciation estimates. Having made the life estimate, in order to prepare the estimate of depreciation, annual or accrued, it is next necessary to select some formula which correlates the life estimate and depreciation.

Most familiar of such formulas are the "straight-line," sinking-fund, and compound-interest or present-worth depreciation methods. The remaining-life method, a relative newcomer, may be regarded as a variation of the "straight-line" method. There are a number of others which are seldom encoutered in actual practice.

At this point a host of new problems arises. Many executives are profoundly convinced that the routine determination of depreciation, by means of a life estimate based on past experience which is substituted in an arbitrary formula, is a grave mistake and a travesty on the managerial function.

On the other hand, some regulatory authorities have indicated a desire to prescribe the exclusive use of the "straight-line" method of depreciation accounting.

The amount of reserves has occasionally been criticized by various commissions in the light of a theoretical "reserve requirement" established by applying some depreciation formula retroactively. It has been proposed to regard this "reserve requirement" as an admitted loss of value, and so use it in determination of net worth or rate base.

Obviously, these are complicated matters of far-reaching importance. Sound solutions must wait upon complete understanding. Quite often, differences cannot be reconciled, and the courts become the umpire.

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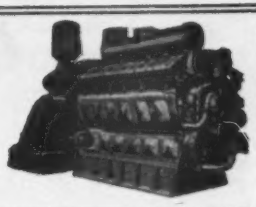

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1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Coan. Exciter
1—	400	Westgh.	Non-Cond.—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
1—	300	G.E.	Non-Cond.—150/175 lbs., 5/10 lbs. B.P., 480-3-60W

FREQUENCY CHANGERS

KVA	Make	RPM	Voltages	Frequency
1—3750	G.E.	300	2400/4150—2400/4150	25/60/25
1—3125	G.E.	300	2400/4150—2400/4150	25/60/25
2—2500	G.E.	750	2400/4150—2400/4150	25/62½/60/24

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6600/13200
2—	2000	G.E.	500	600 25 cy.	3300
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2200/4400
2—	1500	G.E.	514	250	6600/13200
3—	1500	G.E.	600	600	2300/4160
1—	1000	G.E.	900	250	4100/6900
1—	1000	Whse.	900	600	2300/4160
1—	500	Whse.	900	250	6600/13200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	300	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	250	G.E.	900	125	4160
1—	150	G.E.	1200	275	2300
1—	100	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
3—1250	G.E.	HVDDJ		6600x460
1—1150	A.C.	OISC		13200x460/2400
3—1000	G.E.	HVDDJ	1	2200x440
9— 300	G.E.	HT	3	24000x240/480

BELYEA COMPANY, INC.
OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

TRANSFORMERS

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.
ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V, 2200V Pyranol
2—750 KVA G.E., 3 Ph., 4150V, 120/240V. sec.
1—400 KVA Pitts., 1 Ph., 2400/4800V, 240/480V.
3—333 KVA Whse., 1 Ph., 2400V, 600 V sec.
2—200 KVA G.E., 3 Ph., 4150V, 120/240V. sec.
1—200 KVA G.E., 3 Ph., 2400-220 Sec.
3—100 KVA Whse., 1 Ph., 13,200V—230/440.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G. E., 1800 RPM, 220V, 3/60
2— 150 H.P., Al. Chal. 360 RPM, 440V, 3/60

MOTOR GENERATOR SETS

1—1000 KW G.E., 600 V, 514 RPM, 4000V Syn.
1— 200 KW Whse., 275V, 900 R.P.M., 220 V Syn.
1— 175 KVA West., 1Ph., 230V, Motor 3Ph., 460V.
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V, 900 RPM, 2300V, Syn.
1— 75 KW C.W., 250V, 1200 RPM, 2300/4150 Syn.

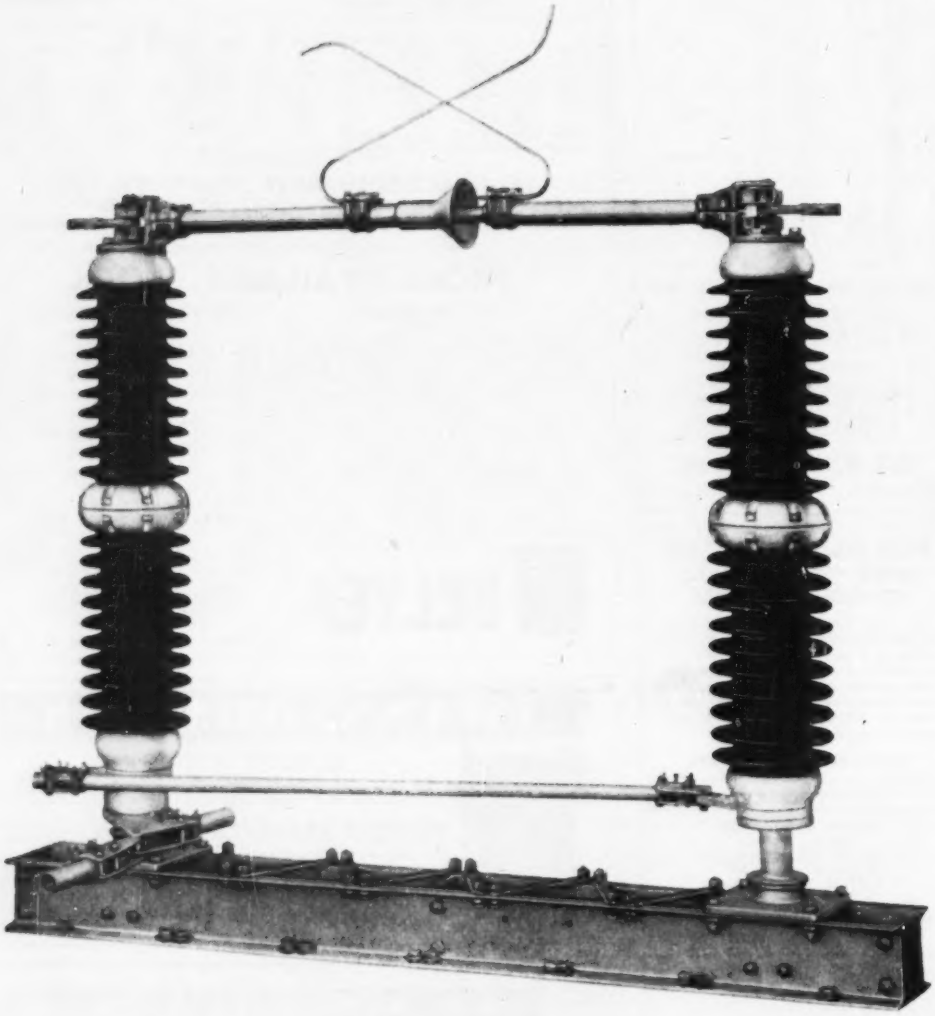
SLIP RING MOTORS

1— 400 H.P. West. CW, 450 RPM, 550V.
1— 250 H.P., West., CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3Ph. 60 Cy.
1— 100 H.P. G.E., 187 600 RPM 440V.

Large Stock of A.C. and D.C. Equipment

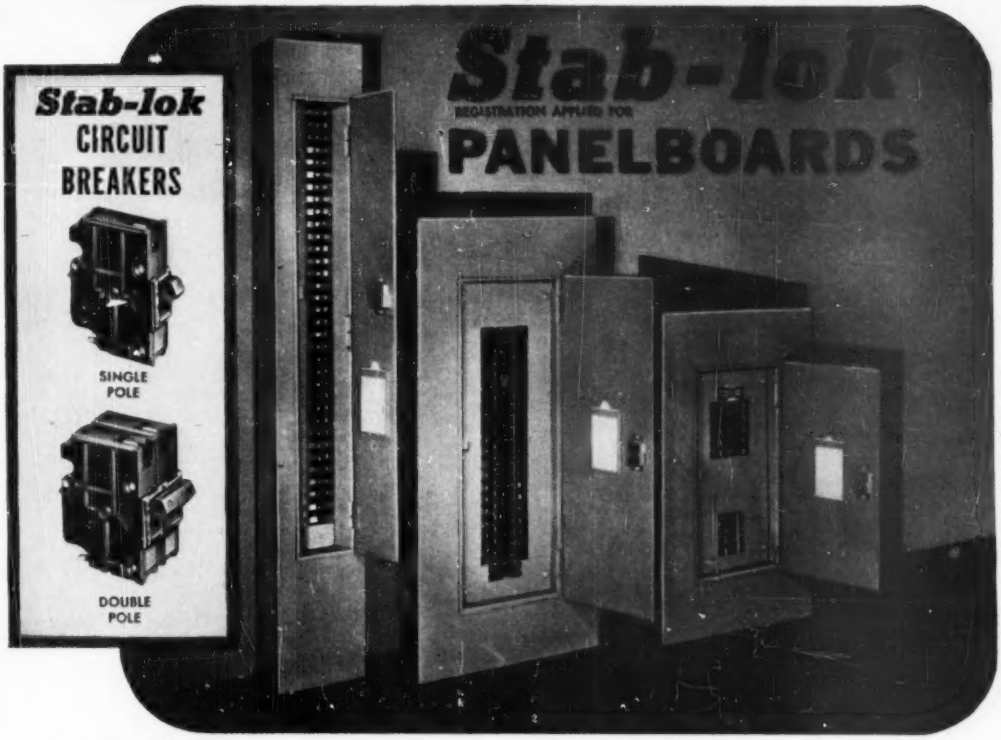
Cole Electric Co.

9439 Steller Drive TExas 0-4701 Culver City, Calif.



AIR BREAK DISCONNECTING SWITCH
115,000 Volts—600 Amperes—Type PU
Horizontal Mounting—Three Pole—Center Side Break—Group Operated
SILVER TO SILVER CONTACTS
One Pole Shown
See Bulletin 40A

WHY WAIT? IN MINUTES, YOU CAN ASSEMBLE



NO MORE WAITING for factory panelboard assemblies. Simply get the correct size enclosure and the required number of one and two pole Stab-lok Circuit Breakers from your distributor's stock and assemble your panelboard in minutes. These Federal Noark Panelboards meet most any requirement, too, for they're available up to 42 circuits.

And when you install Stab-lok Panelboards you get the time- and money-saving advantages of Federal Noark modern design. There are 4½" gutters for easy wiring . . . and the whole interior is quickly removable to give you complete box accessibility for wire pulling. The trim lines up automatically. Polarity sequence bussing provides full flexibility for practically any circuit requirement.

For on-the-spot delivery and today's lowest costs, order Federal Noark Stab-lok Panelboards from your distributor. Federal Electric Products Company, 50 Paris St., Newark 3, N. J.

WHY STAB-LOK PANELBOARD IS QUICKEST, EASIEST TO INSTALL

BREAKERS SNAP IN PLACE: No screws! No tools! Slots in bussing take either single or double pole Stab-lok circuit breakers.

ONE MAN INSTALLATION: Trim hangs on a support bracket, leaving workman's hands free. Holes always line up.

REMOVABLE INTERIORS: Simply lift the interior from the box. To replace you merely hang on support bracket.

AUTOMATIC ALIGNMENT: If box is installed at an angle, merely shift trim front. Springs give positive, automatic plaster alignment, too.

DEAD FRONT FOR SAFETY: Filler plates give panelboard solid, unbroken front. With door locked, the panelboard is tamperproof.

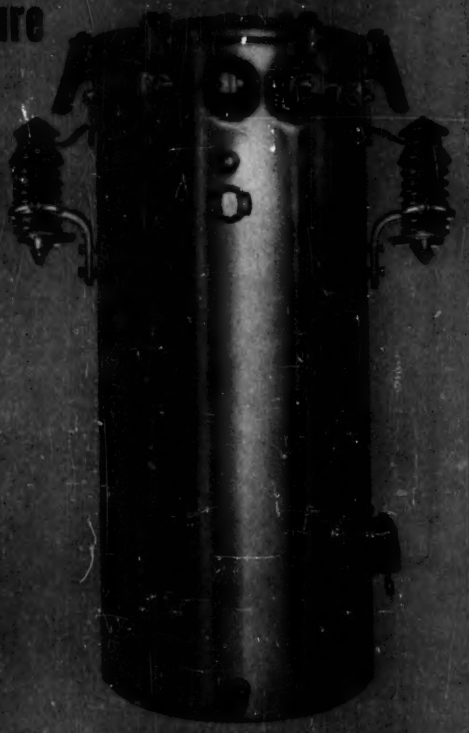
FEDERAL NOARK

Federal NOARK

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

TRANSFORMER OPERATORS' GUIDE:

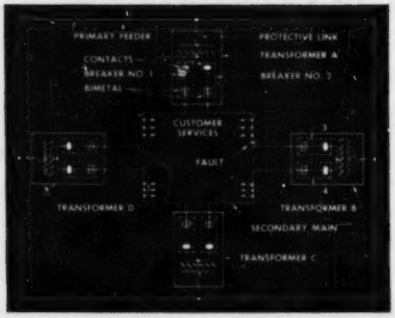
How do KUHLMAN CSPB* transformers protect equipment and assure uninterrupted service?



In high load areas, distribution transformers are often banked with both primaries and secondaries connected to a closed loop with "built in" circuit breakers. This arrangement provides two main advantages. It protects equipment against excessive surge voltages and the concentrations of power at fault points; and it assures uninterrupted customer service by permitting transformers in the bank to "gang up" to supply power to any point where there is an increased demand.

You get these advantages when you use Kuhlman CSPB banked transformers: (1) rapid fault location with a minimum load loss and service interruption, (2) reduced voltage drop due to low effective impedance of paralleled transformers, (3) reduced flicker caused by suddenly applied loads, (4) short-time overloads carried safely, because of the thermal loading provided by secondary breakers, (5) isolation of faulty transformers by primary protective link and secondary breaker, and (6) all protective devices included in one single installation, eliminating cumbersome accessories.

Here's how it works . . .



Assuming a fault occurs at X in the diagram, the Kuhlman CSPB transformer bank operates as follows:

1. The fault draws current from the transformers in inverse proportion to the total impedance of each transformer.

2. Transformers A and B, being adjacent to the fault, supply the bulk of the fault current. This current combines with the fault current from transformers C and D, flowing through the bimetals of breakers 2 and 3.

3. At the same time, the fault currents from C and D oppose the load currents in breakers 1 and 4, causing breakers 2 and 3 to open and isolate the faulted section.

4. With the faulted section isolated, transformers A and B will continue to furnish their former share of the load through breakers 1 and 4 to the remaining network.

5. A red signal automatically lights on the transformer connected to the faulted circuit, in this case transformer B.

Kuhlman ELECTRIC COMPANY, BAY CITY, MICHIGAN K E